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CONTENTS.

EDITORIALS:
Rates for Cooking and Heating.....477
Industrial Substation Design.....478
Temporary Fire Risks in Electric Plants.....478
Studying Industrial Processes.....479

DEPARTMENTS:
Commercial Practice 485
Electric Vehicle Data.....488
Electrical Construction 489
Dollar Wiring Kinks.....492
Public Service Commissions.....493
Questions and Answers.....495
New Electrical and Mechanical Appliances.....507
Latest Approved Fittings.....512
Current Electrical News.....513
Record of Electrical Patents.....517

LEADING ARTICLES:
Electricity in An Ore-Treating Plant.....481
Electrical Engineering Problems.—By R. G. Hudson and W. V. Lyon.....497
Appraisement of Small Electric Properties—II.—By Edwin D. Dreyfus 500

MISCELLANEOUS:
Organization of Associated Manufacturers of Electrical Supplies 480
Chicago Jovian League.....480
Rejuvenation at Toledo.....480
An Automatic Electric Iron for Window Display.—By Frank D. Burr.....485
Minimum Charge 485
Safety Meeting in Louisville.....485
Electric Oven Gives Remarkable Results in Toronto Bakery 486
Program of Ohio New Business Meeting.....486
Electric Shop Operated by Kansas Municipal Plant.....487
Company's Service Protected by Employees' Prompt Action 487
Meeting of Chicago Electric Vehicle Men.....488
Evolution of Concentric Wiring.....489
Recent Developments in Concentric Wiring in Germany..490
Utah Contractors Dine.....490
Mounting Motor In Concrete Building.—By William T. Estlick 490
Licensing and Inspection Proposed in Iowa.....490
Among the Contractors.....490
Electrical Show at University of Illinois.....491
National Electric Week Launched.....506
Program of Convention of Iowa State Section.....506
Chicago Electric Club Meeting.....506

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RATES FOR COOKING AND HEATING.

While electric cooking does not depend for its introduction upon its economy, other advantages far outweighing the saving of energy involved, it is nevertheless a fact that its introduction must be slow where considerations of cost are counted against it. Consequently where rates for lighting current are charged for electricity used for cooking and other applications of heat, the progress in arriving at a wider use of heating and cooking devices is slower than would otherwise be the case. Many central stations are making a special classification of this service, with a rate calculated to stimulate a wider introduction of this activity. In a number of Western communities this development has reached an advanced stage.

Upon inspecting a table of classified rates for the central stations of England, however, we are impelled to point out that conditions there have reached a stage much more favorable to the extension of this branch of the service. Fully half of the cities show special rates for heating and cooking, and in the remainder the rate is usually the same as for industrial power. We have frequently had occasion to refer in these columns to the Point Five Association, made up of managers of plants charging a halfpenny (one cent) per kilowatt-hour for energy used for cooking and heating. There are now 22 of these. Some of them have a demand charge in addition to the energy charge, but it is to be noted that five have a straight energy charge. This is real encouragement, and the growth of electric cooking in such districts is readily understood. Outside of the "Point Fives," there are many cities and towns where a heating rate of two or three cents per kilowatt-hour is charged—indeed this is fairly general.

In Toronto, Canada, an off-peak rate of 0.5 cent per kilowatt-hour is available for this service, and an article in this issue tells of its application to baking bread in a commercial bakery. While the saving over the previous cost of fuel would be wiped out if this rate were doubled, it is shown that other advantages are obtained, such as saving in labor, quality of product, cleanliness, space requirements and continuity of operation. These advantages are seldom realized until they have been experienced, and their importance cannot be too strongly emphasized to the prospective user of similar service. Similarly, in the cooking of meats, it has been amply demonstrated that the reduction in shrinkage is an important element.

INDUSTRIAL SUBSTATION DESIGN.

Recent studies of industrial substation layouts disclose a wide difference in arrangement among local plants. In some cases the transformers are mounted out of doors on concrete piers, with disconnecting switches on angle-iron frames supporting the line insulators; in others fireproof quarters are assigned inside the mill or in a projecting bay well cut off from the producing departments; and again, the equipment may be mounted in a separate building in some convenient corner of the property or even across the street, if the runs are short to the center of distribution. It is out of the question to expect anything like standardization in the arrangement of factory substations, in view of the immense range of local conditions to be met, but in laying out work of this kind, it is well to bear in mind what to avoid as well as what to emulate.

Plenty of space is very important in work of this kind. Not only is it desirable in the interests of safety to provide a clearance of from 30 to 36 inches whenever feasible between the rear of switchboards and the substation wall, but it is expedient to avoid obstructing such passages with curved conduit, even where it is seldom necessary to pass behind the board. The extra cost of right-angled conduit fittings is well warranted, and in cases where the leads are too heavy for convenient drawing, it may be worth while to resort to bus runs in order to give the necessary free working space. In some of the best mill practice, feeders from the local switchboard are run upward from floor to floor through a vertical shaft in the form of exposed copper buses from which taps are made for the motor service in the various departments. This arrangement is fairly expensive, and is used to advantage where the loads are heavy and the number of local distribution centers is great, but probably would not pay in small plants.

Symmetrical arrangements of switchboard equipment are worth all they cost in convenience. This means, to be specific, that the same sort of instruments should be provided for every power and lighting circuit, with such totalizing meters as may be deemed necessary locally. Sometimes in changing over a factory from mechanical to electrical drive it is necessary to rearrange the distribution center somewhat, and at the risk of a slightly increased cost, it pays to unify the switching and instrument facilities. If each feeder circuit is in general to be provided with a recording wattmeter, there should be no exceptions, such as providing one or two circuits with ammeters left over from service elsewhere in the plant. All should be treated alike, so that the records can be maintained on a comparative basis, and in this way possible mistakes are minimized.

Concentration of circuit control is another desirable feature in mill substation layouts. Many times engineers taking up this work will find generators and small switchboard panels scattered around the factory buildings, with local short runs for either power or lighting cables, or both. If either class of service is concentrated at one point, it is generally desirable to make a complete job of it and to consolidate all services at one board. It should not be the plan to allow lighting control to remain in one part of a mill and power control in another, unless as a temporary expedient. When emergencies arise, quick action becomes necessary, and no time should be lost in going from one center of electrical control to another, barring, of course, the desirability of maintaining local junction boxes and switch cabinets for sectionalized work in local departments. Generally speaking, it ought to be possible to cut off the entire power and lighting supply of a mill or group of factory buildings by the operation of one or at most a very few switches at one point, and mill engineers as a rule appreciate this to the full. Perhaps it would be hard to find any branch of electrical practice in which there is more room for good mechanical engineering design in combination with electrical development than in the field of mill power.

TEMPORARY FIRE RISKS IN ELECTRIC PLANTS.

The ease with which fire hazards may be increased even in electric plants of first-class construction was emphasized in a recent paper by Mr. N. H. Daniels, of the Stone & Webster organization, before the Boston Society of Civil Engineers. The author pointed out that in many instances a part of the plant space is used at some time or other for the storage of combustible material, and that such practices should be avoided. He recalled visiting a small substation which was entirely fireproof and which normally contained no combustible material save a small amount of waste used in wiping machines, together with a barrel of lubricating oil. The waste was stored in standard cans and the oil in a standard cabinet. Apparently the conditions with respect to fire danger were ideal. On a later visit, however, the author found that an unused section of the floor, where it had been planned to place an additional machine, had been given over to the storage of supplies of another department and was piled high with boxes and crates.

Some of the boxes contained fragile material packed in excelsior. Some had been opened, the contents removed and the excelsior exposed. Had a match been thrown into this pile or had a flame from any other portion of the station been carried to it by a gust of wind, it would have been practically impossible to prevent a fire, which would have reached and softened the light steel trusses which supported the roof. The danger was greatly increased by the fact that several planks which were used for a walk when snow was on the ground, had been stored up among the roof trusses and would have added to the fire if it once started. This storage was not contemplated when the substation was laid out, but it materially increased the fire hazard, particularly as the station was protected only by two three-

gallon chemical extinguishers and the nearest hydrant was about 500 feet distant.

Later another hazard was introduced into this same station, owing to the burning out of the armature of one of the machines. In order to make repairs it was necessary to take the machine apart and a good deal of wood was used in blocking up while repairs were in progress. Some repair parts came packed in excelsior, and both packing cases and excelsior were allowed to lie around while the repairs were under way. Further, as the damage was to electric winding, gasoline torches were used to solder certain joints, and these introduced another element of danger. Fortunately no fire occurred and normal operation was resumed, the combustible storage being removed and the last machine being put in place, so that the substation passed through a cycle in which is was first an excellent fire risk, then a poor one, and finally was again relatively free from hazards.

The author emphasized the importance of careful handling of gasoline torches around wooden blocking, citing cases where fires had occurred through the careless placing of these devices within too close range of inflammable material and also through mechanical injury to torches in operation.

STUDYING INDUSTRIAL PROCESSES.

Central-station power and illuminating engineers in active practice cannot help learning a vast amount about many different kinds of business and manufacturing if they improve a half of their opportunities, and yet we are inclined to believe that in a good many cases, pressure of work keeps men from acquiring really expert knowledge of industries outside their immediate specialty. If conditions in plants were less diverse, applications of electric service would be far more cut and dried than is the case now, and it is this very breadth of opportunity which brings such a reward to the power or lighting solicitor who goes at his work scientifically.

The entrée which the soliciting engineer has into industrial establishments often closed to the public should be utilized to the utmost degree. In some cases confidential data will be obtained and will properly be maintained in the solicitor's private field sheets; in others, the investigation will afford an opportunity to obtain material worth discussing with other engineers or contributing to the technical press; and often, too, the entrance of central-station service into a plant will provide one of the finest opportunities in the world for the preparation of a newspaper story about the modernization of an existing or newly established concern which might run on for years without even a local press mention if the central-station representative does not see the possibilities in the way of getting a little legitimate space in the daily or weekly as a result of the adoption of electric motive power or the equipment of the plant with the latest type of lamps.

To do this kind of work efficiently a man must keep pretty full notes and must not postpone writing down his field observations and records any longer than is absolutely necesary, once those data are in hand. In very large cities specialization often becomes necessary among soliciting engineers, but in most central-station organizations, the problems of the consumer may meet almost any one of the staff. The solicitor should take a leaf from the book of the physician here. Every case in his practice deserves notation in permanent record form; not the disjointed and often half-legible records inscribed hit-or-miss under the stress of observation in a hot engine room or in some dark and distant department section, but the nub of the engineering problem should be constantly sought and recorded, and above all, studied at leisure where, if necessary, plans can be made to fill out gaps in the field notes and so to create and maintain an invaluable assembly of material. Almost every power engineer can recall cases where he was hurried off the job before it was really completed, in order to take up some other problem; where he resolved to go back in a day or two and round out his field notes but never did so.

If a solicitor succeeds, for example, in securing a contract for electric service in a bakery, then is a good chance to make full notes on the amount of material required and the time necessary to turn out every kind of product the establishment makes. It is one thing to know what size of motor will drive a given type and rating of dough mixer and another to find out and put into one's own loose-leaf book the full operating details of the plant in which the machine runs, depending of course upon the willingness of the proprietor to advance information which cannot be gathered by observation. It pays to put down the number of men required to run a given machine layout, to sketch roughly the arrangement of the establishment when time permits, and to look up the recent numbers and indexed volumes of the trade journals in each field attacked in the central-station interest, so as to acquire in as short a time as possible, a good working knowledge of every industry in which one operates.

Few people have anything like the opportunities of the central-station man to acquire information of authentic character as to varied industries, on the basis of an inside analysis. To fall short of extracting every bit of information possible which may help in the investigation of the electrical requirements of subsequent prospects is to lose opportunities of the greatest value. It should never be forgotten that the fundamentals of electric-service application are closely related to those of the efficiency engineer, and that very often suggestions as to bettering local conditions, which are in reality mere by-products of a power or lighting survey, accomplish a great deal in helping the desired customer to give central-station energy a trial. A little more of the German method of investigation combined with the alert and responsive interpretation of the American can be used to advantage in a good many central-station commercial organizations dealing constantly with important industrial problems.

Organization of Associated Manufacturers of Electrical Supplies.

A meeting of electrical manufacturers to organize a permanent association was held at the Hotel Biltmore, New York City, on Tuesday, March 9. More than one hundred gentlemen were present, representing 75 distinct concerns and companies. Forty-one secured membership and all individuals, firms or companies acquiring membership within 30 days are to be enrolled as charter members. R. K. Sheppard, of B. F. Goodrich Company, chairman of the General Committee, presided, calling the meeting to order at 10:45 a. m. W. F. Field, of the Phillips Insulated Wire Company, was appointed secretary, and the names of all present were recorded. LeRoy Clark, chairman of the committee appointed for the purpose, reported the following names for members of the Committe of Business and Technical Experts on Concentric Wiring, and the report was unanimously approved:

W. H. Blood, Jr., National Electric Light Association.

W. C. Bryant, Bryant Electric Company.

F. V. Burton, Bryant Electric Company.

C. E. Corrigan, National Metal Molding Company.

H. B. Crouse, Crouse-Hinds Company.

L. W. Downs, D. and W. Fuse Company.

Gano Dunn, J. G. White Engineering Corporation.

E. B. Hatch, Johns-Pratt Company.

D. C. Jackson, Massachusetts Institute of Technology.

G. S. Lawler, Associated Factory Mutual Fire Insurance Companies.

Dana Pierce, Underwriters' Laboratories, Inc.

W. T. Pringle, Pringle Electric Manufacturing Company.

H. R. Sargent, General Electric Company.

R. K. Sheppard, B. F. Goodrich Company.

C. E. Skinner, Westinghouse Electric & Manufacturing Company.

J. R. Strong, Tucker Electrical Construction Company.

Gerard Swope, Western Electric Company.

J. H. Trumbull, Trumbull Electric Manufacturing Company.

Also a representative of the Bureau of Standards, Washington, D. C.

W. T. Pringle, chairman of the Committee on Organization, reported a series of resolutions favoring the national association of electrical supply interests and presented a complete constitution and by-laws under which the organization could begin work at once. These were adopted in full without change and copies are to be printed and sent to all who were present. The new organization is to be known as the Associated Manufacturers of Electrical Supplies, and the management of the association is to rest in a board of 15 governors, who shall be elected annually. Names for governors were recommended by a nominating committee, and the gentlemen named were elected as follows: A. W. Berresford, Cutler-Hammer Manufacturing Company; Charles Blizard, Electric Storage Battery Company; LeRoy Clark, Safety Insulated Wire and Cable Company; H. B. Crouse, Crouse-Hinds Company; D. C. Durland, General Electric Company; H. R. Holmes, R. Thomas & Sons Company; J. F. Kerlin, National Carbon Company; Everett Morse, Simplex Electric Heating Company; J. W. Perry, H. W. Johns-Manville Company; W. C. Robinson, National Metal Molding Company; Walter Robbins, Wagner Electric Manufacturing Company; R. K. Sheppard, B. F. Goodrich Company; Gerard Swope, Western Electric Company; Charles Weston, Weston Electrical Instrument Company. The governors shall choose each year from their own number a president, vice-president and treasurer to hold office for one year from April 1. They shall also choose a secretary who shall hold office at the pleasure of the board of governors and be a paid official.

The objects of the association, as set forth in the constitution, are to advance and protect the interests of the manufacturers of electrical supplies and of the manufacturer's of materials entering into electrical construction, in manufacturing, engineering, safety and other problems, to promote the standardization of electrical material, to collect and disseminate information and to promote co-operation among the members. Membership in the association is limited to corporations, firms and individuals actively engaged in the manufacture of electrical supplies or in the manufacture of material entering into electrical construction. Each member is to be represented in the association by an "executive" representative or representatives and each member may also enroll one or more representatives who shall be known as "associate" representative or representatives. The annual meeting is to be held on the third Thursday in March of each year after 1915.

For the purpose of accomplishing the objects of the association more effectively, the members may be divided into groups, according to the character of electrical supplies or materials they manufacture. These groups shall be known as sections of the association and members may at their option affiliate with and become members of any one or more of them in which they are respectively interested by reason of the products they manufacture. A member not affiliated with any of the sections shall still be entitled to all other privileges of membership in the association. The initiation fee is $25 with annual dues of "executive" representatives at $40 and "associate" representatives at $10. Nineteen designations of lines of manufacture under which sections may be organized were given in the report submitted to the meeting.

Four committees in addition to others named, are Membership, Finance, Legal and Publicity. The meeting adjourned *sine die* at 3:00 p. m., having met at 2:00 p. m. after a recess, to elect the board of governors. The board of governors assembled immediately after the adjournment of the general meeting and the following officers were elected to serve for the ensuing year:

President, R. K. Sheppard.

Vice-President. H. B. Crouse.

Treasurer, J. W. Perry.

The selection of a secretary was postponed. A committee of three, consisting of LeRoy Clark, W. C. Bryant and R. K. Sheppard, was appointed to represent the association on the technical and business committee on concentric wiring and allied problems.

Before adjournment a beautiful silver loving cup was presented to Chairman R. K. Sheppard by his fellow members of the committee in appreciation of his energetic and valuable services. Mr. Sheppard responded with a few graceful remarks and was much applauded.

Chicago Jovian League.

Alexander Shane, of the Chicago Bureau of Safety, was the speaker at the meeting of the Jovian League of Chicago on March 8. He spoke of the marked reduction of industrial accidents, particularly among utility companies, during the past year. Education of the employee is one of the most important factors in accident prevention, as a large majority of all accidents are due to carelessness.

J. C. McDonnell, chief of the Bureau of Fire Prevention and Public Safety, Chicago, also spoke briefly.

Plans were announced for the rejuvenation which will be held in Chicago on March 17 at the Hotel La Salle.

Rejuvenation at Toledo.

The Toledo Jovians held a rejuvenation at Zenobia Hall, Wednesday, March 3, at which time about 15 new members were admitted to the Order. E. R. Kelsey, advertising manager, Toledo Railways & Light Company; R. A. McGregor, and A. K. Young of the same organizations gave interesting talks on the subject of co-operation and the value of the Jovian organization. Statesman Thomas F. Kelly of Dayton was present and told of the work being accomplished by the Dayton Jovians.

Electricity in An Ore-Treating Plant.

This article describes the application of electric power to ore-treating plants, an industry that is peculiar to the West. Motors not only play an important part in the operation of the various machines, but electrical energy is used in the actual separation of the ores. Details are given of the processes and the problems of motor application.

A plant in which a new method for the treating of ore is used has been in operation in Denver, Colo., for over a year by the Sutton, Steele & Steele Manufacturing, Milling & Mining Company, which operates its manufacturing plant at Dallas, Tex. By means of this treatment high-grade ore is produced from low-grade ore. The plant is run as a demonstration mill for the testing and treating of ore coming from the mine of a prospective buyer, and by means of the tests produced by this equipment, proving to the customer the efficiency and effectiveness of this manner of treatment and depending also upon the tests for the sale of machinery. A test must be made of not less than a carload to 100 tons before proper machinery is recommended. The equipment is also used as a custom mill for the treatment of various ores which are brought to it, and the revenue thus obtained is used for paying the cost of operation.

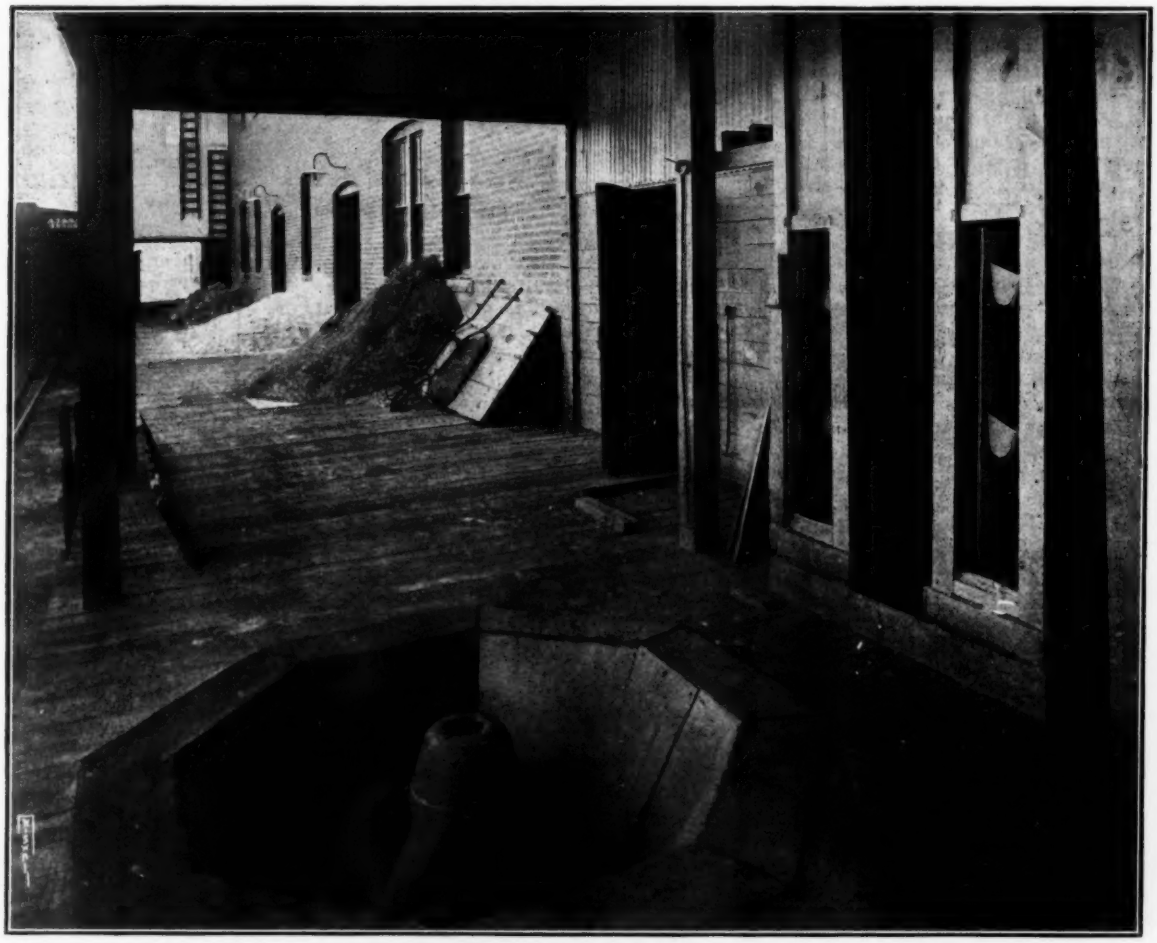


Fig. 1.—Receiving Hopper of Gates Crusher. Bucket Elevators Shown to the Right.

A railroad track has been built alongside the mill, and the ore is unloaded from the cars to the platform where it is fed into a Gates No. 5 gyrotory crusher, shown in Fig. 1. A bucket elevator carrying buckets 8 inches by 10 inches, spaced 18 inches apart and 40 feet between centers of pulleys, raises the crushed ore to the bins at the upper part of the mill. The ore is then taken as required for treatment by means of chutes from these bins, samples being taken out intermittently by a Vizant sampler, the ore going first to a rotary dryer built by P. McFarlane & Son, Denver. This device is 48 inches in diameter, 20 feet long and operate on a slope of one inch to one foot, rotating at four revolutions per minute and maintaining a temperature at 170 degrees Fahrenheit.

The ore is delivered from the chute into a hopper at the upper end of the dryer and discharged at the lower end, bone dry, upon belt conveyors. The heat is supplied from the furnace, being discharged into the upper end of the dryer and drawn through to the lower end and returning through a passage on the outside of the ore-containing cylinder in squirrel-tail fashion to the stack at the upper end of the dryer.

Conveyors carry the ore to a bucket elevator which raises it to bins in the upper part of the mill. From these bins the ore is conveyed by chutes to trommel screens and all the particles of the ore over one-quarter inch in size are

conveyed to an American ring pulverizer, and all is then taken to the Sutton, Steele & Steele patented sizer, Fig. 2. This device can separate the dry pulverant into from 10 to 100 sizes, and avoiding the use of screens, does much better work. It consists of an endless rubber belt, 15 feet between the centers of the pulley and six feet wide. One edge is raised so that it moves transversely at an adjustable pitch of 30 degrees to 40 degrees. The outer surface of the belt is corrugated into V-shaped grooves, one-thirty-second-inch deep, equivalent to 200 mesh at the upper edge and gradually increasing in depth to three-sixteenths inch, equivalent to eight-inch mesh at the bottom. The upper pitch of each groove is 40 degrees and the lower 60 degrees, so that the particles lodging in each groove are retained in the places where they fit. The upper layer of the endless belt is carried by 24 rollers and the power is transmitted to them through a pulley to a shaft by bevel gears at the top end of each roller. Each roller has a cross section which consists of a ten-sided polygon which rotates against the under side of the belt at a speed of 100 revolutions per minute, thereby causing the vibration to the belt.

The dried crushed ore then enters upon the surface of the belt at the upper left-hand corner by means of chutes emptying into a feeder. The large particles, on account of the vibration, roll down the pitch until they lodge in a groove of corresponding size, and are then conveyed in that groove to the end of the belt where they fall into corresponding tubes through which they are conveyed to separate bins or containers.

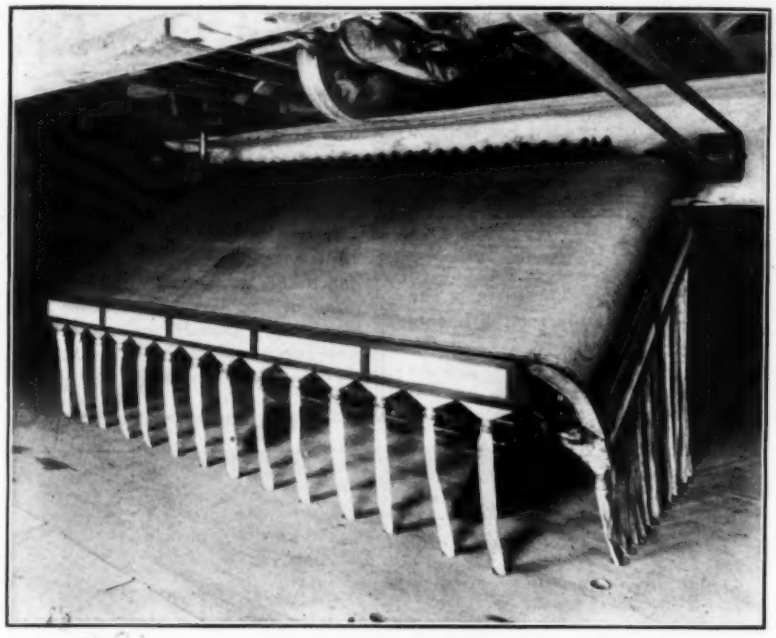


Fig. 2.—Motor-Driven Sizer.

After being sized, the ore is then taken to the dry concentration tables, shown in Fig. 3, by means of chutes. This treatment constitutes what is called the close sizing method and this selects high-grade ore out of the low-grade ore. This concentrating table uses air instead of water in order to float the particles of ore. The air is more mobile than water and therefore the process is much more rapid and closer distinctions are obtained. Very positive separation of minerals is obtained by this treatment. The ore is graded usually into eight to fifteen sizes and each size is handled separately.

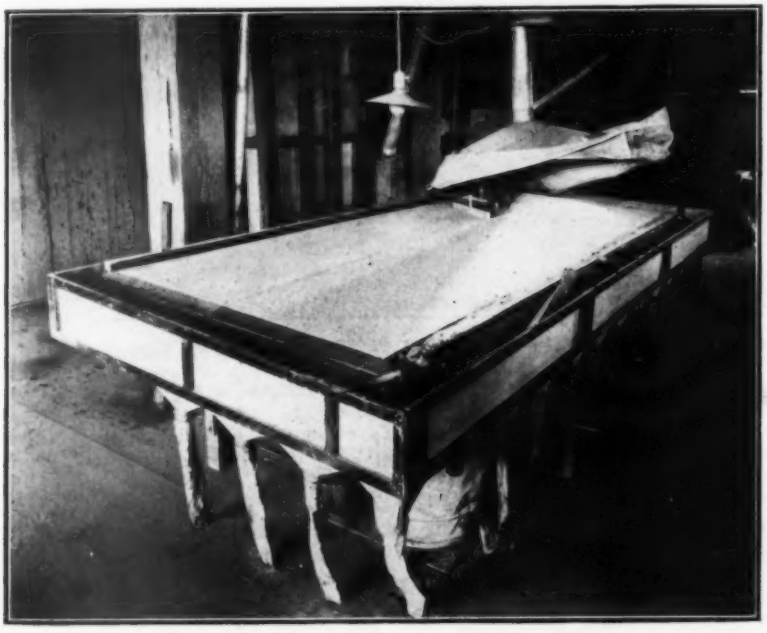


Fig. 3.—Dry Concentration Table Operated by Motor.

This table consists of a smooth cloth-covered deck with a shallow wind chest under it. A National blower with six-inch discharge, running at 250 revolutions per minute, shown in Fig. 5, supplies air to the wind chest at low pressure. The table is vibrated by a reciprocating motion, the angle of the legs giving a slight, progressive travel to the material on the deck. By virtue of the air film under the material on the deck, very little wear occurs on the cloth, evidenced by two of these tables treating sharp, crushed garnets for sandpaper continuously for the past two years with the same cloth. On light or fine material little air is used and the capacity is also lower, while on heavy or coarse material the capacity is larger and more air is used. In all cases the air filtering through the cloth deck is regulated by a lever connected to a gate on the intake of the blower and only sufficient volume and pressure allowed to partially support the deck load.

The variations in weight between the different particles of the mixture, together with the supporting or lifting action of the air under the pulp while being agitated by the progressive movement of the deck, causes them to form in strata, the particles of lowest gravities reporting on the top almost instantly, the heavier naturally remaining on the bottom, and all the intermediate gravities in their respective strata between, thus accurately stratifying the different gravities on the deck. The progressive throw of the deck attracts the strata forward, while the in-

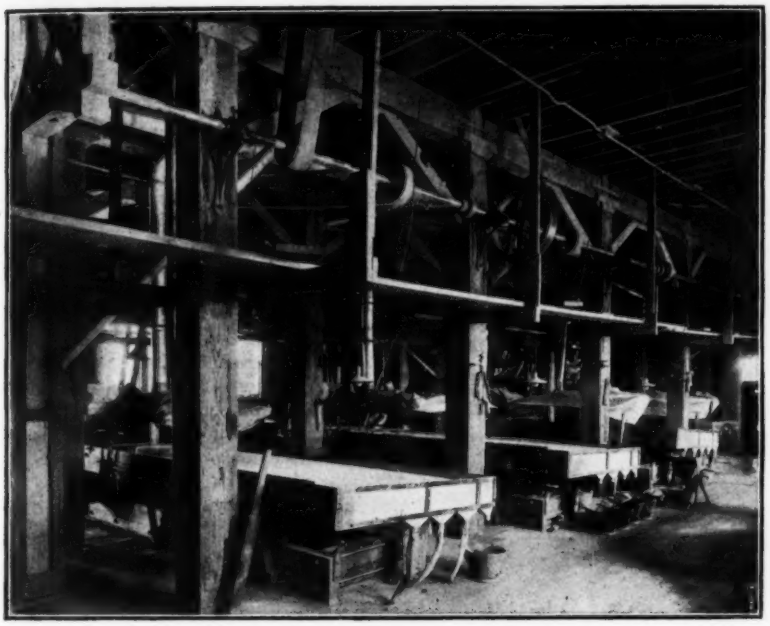


Fig. 4.—Concentrating Room—Operated by Motors.

cline of the deck attracts them downward; therefore, the lower stratum, being heavier and lightly touching the deck, is influenced most to travel with the throw of the deck, while the upper strata, being lighter and on top, and not touching the deck, are influenced slightly more by the incline of the deck and gradually slide off of the stratum next underneath, and after a very short travel, each stratum has slid off the one next under it and appears as a zone on the deck, the zone with the greatest gravity farthest up on the deck and each lighter one in its proper place next below. The lighter the gravity, the faster the travel downward, which assists in parting the different gravities; then the different zones leaning against each other form a solid sheet covering the deck and come off the edge and side of the table continuously for a length of from eight to twelve feet, and by the use of movable fingers the products are parted at any or as many places as is desired, and through small hoppers and spouts on the table conducted to bins or where desired.

By means of this method of treatment ores containing 22 per cent of combined lead and zinc have often been treated and 85 per cent of the mineral saved. The value of this treatment will be appreciated when it is mentioned that in the treatment of ore containing lead and zinc, for example, if sent to a lead smelter a large penalty is imposed on account of the percentage of zinc contained and therefore the expense required for its treatment. Similar conditions are encountered when the ore is sent to a zinc smelter; therefore, after being treated with this process and the lead and zinc thoroughly separated, the lead concentrates may be sent directly to a lead smelter and the zinc concentrates to a zinc smelter, thereby obtaining a greater value for the mineral contained.

In addition to the treatment of ores this machine will also treat and separate mixtures of grains and seeds, eliminating dust, and selecting the fertile seeds from the non-fertile on account of having a greater specific gravity. Seeds have been separated on this machine which are practically 100 per cent fertile, thus being of great value to the agricultural districts and to flouring mills, brewers and others who use seeds and grains in their business.

Some ores are often allied which have nearly the same specific gravity. Such ores are treated in this mill by means of static separators, illustrated in Fig. 6. The principle of the static separator depends on the difference in conductivity of the ores treated. The pulverant must be dry on account of the electric treatment. The action obtained is the same as the old experiment of the pith ball and the rubber rod in the physics laboratory from which it is shown that like charges repel and unlike charges attract. The pith ball is first attracted, and not being a good conductor, clings to the rubber rod for a moment, then, after receiving a like charge, is vigorously repelled. The device consists of four rolls, each of which is electrified by a static charge of 100,000 volts produced by static generators. The crushed ore, being conveyed into a hopper above, feeds along the entire length of the separator, falls upon the electrified roll, and ores having a good conductivity, such as iron pyrite, become quickly charged and repelled into one bin, while the zinc concentrates, being of less conductivity, are longer in being charged and are attracted to the roll which is rotating, and are carried over a partition where they are scraped off into another bin, and the spray of static charge from needles tends to assist in repelling the particles from the roll.

The equipment manufactured by the above mentioned company has been perfected and on the market for sale only since August 1 of the present year, and since that time many Western ores

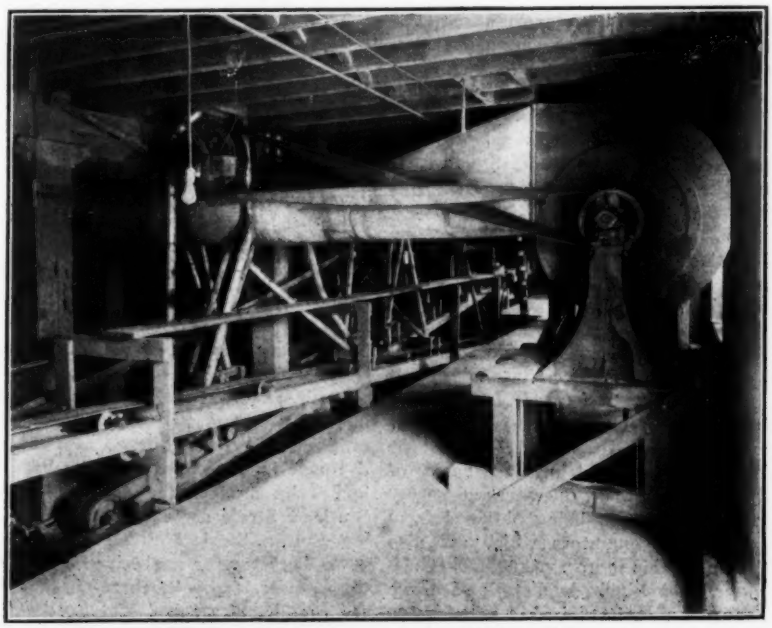


Fig. 5.—Motor-Driven Blower in Concentrating Room.

have been treated. The Ringwood Company, of Ringwood, N. J., has ordered an equipment to handle 200 tons of hematite ore in ten hours. Other Eastern companies handling ores are having tests made.

In all of the processes described electric motors are used to good advantage, the total installation being 275 horsepower, divided among eight motors. The plant employs from 10 to 12 employees, who work 10 hours per day.

The energy consumption per month, for a period of one year, is as follows: September, 7,350; October, 4,740; November, 2,710; December, 8,140; January, 5,690; February, 9,140; March, 3,620; April, 6,780; May, 15,970; June, 8,260; July, 4,210; August, 6,830. The average kilowatt-hours per month is 6,453 and the average kilowatt-hour consumption per month per horsepower connected is 58.2.

In Fig. 1 is shown the receiving hopper of a Gates No. 5 gyratory crusher, into which the incoming ore is emptied. This machine is driven by a 50-horsepower 2,200-volt three-phase motor, operating at 900 revolutions per minute, which also drives through line shafting two bucket elevators, each having 60 4-by-6-inch buckets and three conveyors 10 inches by 40 inches, with six idlers.

A 75-horsepower 2,200-volt three-phase motor running at a speed of 900 revolutions per minute operates one Universal jaw crusher, size 7 by 12, speed 250 revolutions per minute, having a capacity of six tons per hour through a 12-mesh screen; four per cent of moisture; one 48-inch by 20-foot McFarlane dryer running at four revolutions per minute; one set of 14-inch by 27-inch rolls, 100 revolutions per minute; one American ring pulverizer, 600 revolutions per minute, made by the American Pulverizer Company; one Trumbull 3-foot by 6-foot screen, No. 4 mesh, speed 25 revolutions per minute; one Sutton, Steele & Steele 2.25-mesh screen, 300 revolutions per minute; one Sutton No. 6 screen, No. 8 mesh, 125 revolutions per minute; one Sturtevant ring roll, No. 275; and two bucket elevators, each having 60 6-inch by 8-inch buckets.

Two dielectric separators, made by Sutton, Steele & Steele, are driven by a 25-horsepower, three-phase, 220-volt motor, running at a speed of 1,200 revolutions per minute. These separators are known as No. 50 and No. 51, type B, respectively, and have a capacity of two tons per hour, operating at 100,000 volts, the current being obtained from two static generators which are also driven by this motor. A 60-bucket elevator, 4-by-6-inch buckets and three conveyors, each 10 inches wide by 20 feet long, are driven through line shafting from this same motor.

The concentrating tables and auxiliary equipment are driven by a 50-horsepower, 220-volt, three-phase motor. This machine operates at 900 revolutions per minute, the detailed equipment which it drives comprising four Sutton, Steele & Steele 6-by-12-foot concentrating tables, each having a capacity of from 500 pounds to four tons and operating at 300 revolutions per minute; four National blowers, six-inch discharge, operating at 250 revolutions per minute; three Sutton, Steele & Steele conveyors, 10-inch belts, 40 feet between centers, running over six idlers; one Sutton conveyor 10 inches by 50 feet; three conveyors of the same type 10 inches wide by 30 feet long; four 60-bucket elevators, 3-by-4-inch buckets; and one 32-bucket elevator, 4 by 36 inches.

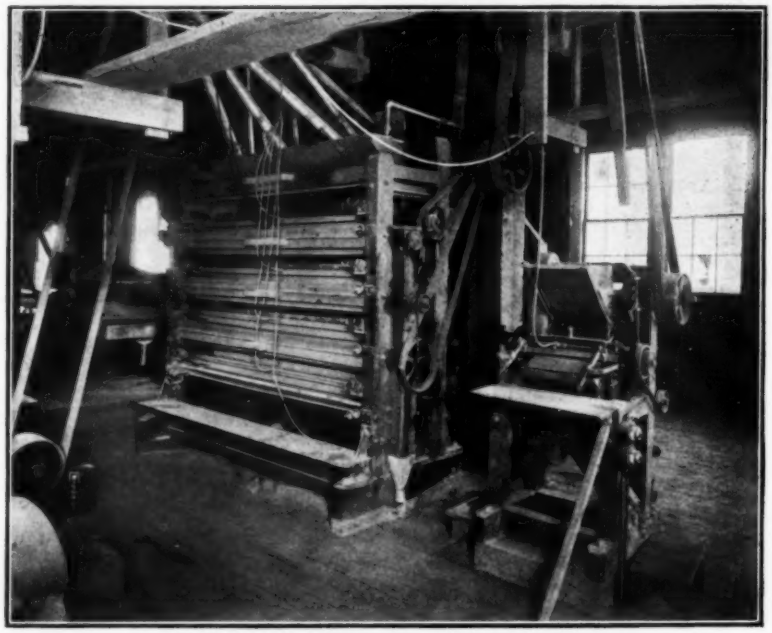


Fig. 6.—Four-Roll Motor-Driven Separator.

A 35-horsepower, 220-volt, three-phase motor, running at 1,200 revolutions per minute, drives through line shafting a Blake 7-inch by 12-inch crusher with a capacity of from 1,000 pounds to 10 tons and an average output of five tons per hour, at 300 revolutions per minute; two sets of 14-inch by 27-inch rolls, speed 100 revolutions per minute, capacity five tons; one 30-inch by 8-foot dryer made by the Colorado Iron Works; one Sutton, Steele & Steele bucket elevator, 60 buckets, 4 inches by 6 inches; and two Sutton, Steele & Steele screens.

A Sutton, Steele & Steele sizer and a 60-bucket elevator are driven by a 25-horsepower, 220-volt, three-phase motor running at a speed of 1,200 revolutions per minute. There are also several small motors installed.

Rejuvenation in Columbus.

A rejuvenation was held in Columbus, O., on February 26, at the Virginia Hotel at which 57 candidates were initiated. Immediately following the initiatory ceremonies, Samuel G. McMeen, president of the Columbus Railway, Power & Light Company, addressed the new Jovians on "Co-operation and Good Fellowship."

A banquet was then partaken of in the Rose Room of the Virginia, accompanied by high-class cabaret features. W. A. Hopkins, president of the Erner & Hopkins Company, acted as toastmaster. The principal after-dinner speakers were C. M. Crofoot, Crouse-Hinds Company, Cincinnati, Statesman-at-large for Ohio, and Thomas F. Kelly, sales manager of the Dayton Power & Light Company.

One of the pleasing features of the occasion was a presentation by the Dayton Jovians to their Columbus brothers of a 10-foot banner of red and gold, bearing the Jovian slogan, "Efficiency Wins." Prizes in the form of gold sleeve-links having the Jovian insignia were awarded J. T. Dunnick and J. W. Davis for securing the largest number of new members. Highest praise was given L. W. Jaquith, of the General Electric Company, chairman of the entertainment committee, and Carl Metz, wire chief of the Central Union Telephone Company, who is first tribute of the Columbus Jovians.

Convention of National District Heating Association.

The annual convention of the National District Heating Association will be held in Chicago, June 1, 2 and 3, 1915, with headquarters at the Hotel Sherman.

Commercial Practice
Management, Rates, New Business

AN AUTOMATIC ELECTRIC IRON FOR WINDOW DISPLAY.

By Frank D. Burr.

During the campaign just closed for the sale of electric irons, toasters and grills by the Denver Gas & Electric Light Company, many displays and demonstrations were arranged in the windows and on the sales floor by F. P. Safford. During the afternoons of several important days, the entire force doing hand ironing from one of the local laundries transferred their activities to the company's display room, displaying fresh, clean shirtwaists and embroidered articles. Many inquiries in favor of the laundry and also relative to the iron were made.

The window display which has proved most entertaining and has attracted the largest crowds has been the automatic electric iron, suggested by the writer, moving back and forth upon a canvas-covered board. After trials of several magnets, one was found which would produce sufficient lines of force to attract an iron over a one-inch board. This was a field spool from a large motor. It was connected in series with a bank of lamps by means of which 250 volts direct current were cut down to about 20 volts, with 10 amperes of current. This magnet was then mounted upon a truck constructed with brass wheels of four-inch diameter which ran upon a track constructed of tool steel. The tool steel being smooth avoided noise and smooth running, while the brass wheels avoided magnetic troubles and lessened the friction running on the steel. This was made to play back and forth over a space of about 32 inches by means of a worm gear driven by a split-phase motor, but due to the fact that 24 reversals per minute were required the motor was running on the starting coil so much it was in danger of being burned out; also at each reversal the belt would slip, causing a squeaking noise which would expose the fallacy. Therefore, air was tried and a cylinder of sufficient length to make the travel of 32 inches was fitted up with a piston and the air was reversed at the end of each stroke by electric solenoid relays. Here, too, it was necessary to reduce the pressure below 110 volts in order to get proper current in the solenoid and an impedance coil was used for this purpose. At the end of one rail was attached a brass spring which made contact with a brass wheel when the truck had reached its end of travel. This brass spring made contact with a circuit which caused a rush of current through one solenoid and through the air valve in reversed condition causing the piston to pull the truck to the other end of its travel when a brass wheel run against a brass contact at the other end of the opposite rail sending a current through another solenoid which again reverses the air, in this way causing the truck to make about 12 cycles per minute. A box was constructed to cover the whole, and the cover of the box was upholstered in canvas which was rubbed with paraffin in order to lubricate the play of the iron so that it would run smoother. The box covering the magnet and air cylinder was then decorated with iron packages and placards. The relay mechanism and the air exhaust and reversing mechanism were installed in the basement, 25 feet away, so that there was no noise or anything to indicate the cause of motion. All details were designed and constructed under the direction of Homer W. Sweet.

After the iron was in operation some little amusement was caused by experimenting with nails which would be attracted back and forth over the same play as the iron, but due to the constant circulating lines of force, these 20-penny nails would circulate and rotate about each other in the imitation of waltzing or dancing characters. These were therefore dressed up by the young ladies in the office as dolls or ballet girls and as many as six of them operating at one time on the board would attract a crowd of 25 to 50 people outside the window when they were at once gathered up and the iron put in motion, thus not only satisfying curiosity but giving amusement to the public and advising them of the place where an iron could be obtained.

Minimum Charge.

A bill for the abolition of a minimum monthly charge by electricity and gas companies has been introduced in the Legislature of Massachusetts. Like bills have been offered and defeated by legislatures of previous years. At the hearing, Everett W. Burdett, for the Massachusetts Electric Lighting Association, defended the present practice of making a small minimum charge, which in Boston is $9 a year. Mr. Burdett said that leakage loss amounts to about 40 kilowatt-hours a year, or $4.00 on a 10-cent rate. In addition, the readiness of service and the expense of meter maintenance make the practice fair and equitable to the customer, while barely covering the cost to the company.

On the question of inspection he recognized the advantages of some sort of local inspection, but it was difficult to find a practical mode. At present a customer can have his meter tested by public official on complaint to the Gas and Electric Light Commission.

Safety Meeting in Louisville.

Formation of a Safety First League in Louisville, Ky., to embrace employees of all the public utility companies of that city, the Louisville Gas & Electric Company, the Louisville Railway Company, the Cumberland Telephone & Telegraph Company and the Home Telephone Company, is expected to result from a joint meeting held recently at the chapel of the Louisville Railway Company. Three hundred representatives of the various companies were present and moving pictures and stereopticon views were used to illustrate the principles involved in the safety first movement. These were explained by A. W. Lee, chairman of the Safety First Committee of the Employees' League of the electric company who presided at the meeting. Definite action toward the formation of the general league was not begun but was discussed at length and will be taken up shortly.

Donald McDonald, vice-president and general manager of the gas and electric company, was one of the principal speakers, and he and others emphasized the necessity of caution in little things. He noted that nine-tenths of the accidents of the gas and electric company involved veterans in the service. C. R. Gilmore, former assistant superintendent of the Louisville Gas & Electric Company's distribution department, was another speaker.

New Buildings in Salem Contract for Electric Service.

In Salem, Mass., since the great fire of June 25, 1914, 330 building permits have been issued, and of these only 11 were without wiring for electricity. Of the number of houses wired 54 per cent were not provided with other means of illumination.

Electric Oven Gives Remarkable Results in Toronto Bakery.

A prominent bakery in Toronto, Can., recently installed an electric oven of the Hughes Electric Heating Company type 300, which is operating with marked success and is proving more economical than the furnace-type oven which it replaced. Energy for the operation of the electric oven is supplied by the Toronto Hydro-Electric System.

In a recent comparative test the electric oven, the capacity of which is 180 loaves of 1.5 pounds, turned out 15 batches in 10 hours, or 2,700 loaves. The brick oven, the capacity of which was 450 loaves of 1.5 pounds, turned out five batches in 10 hours, or 2,250 loaves, 450 loaves less than the electric oven.

The floor space occupied by the brick oven was 256 square feet, while that of the electric oven is 32 square feet.

The fuel used by the brick oven was 0.25 ton of hard coal, which cost $2.00. The estimated fuel cost of 1,000 1.5-pound loaves of bread baked in the brick oven was 89 cents, although the fuel cost ran higher on several nights when there were only three or four batches put into the brick oven. The fuel cost for the electric oven would not be higher in case of the oven not being used regularly, as the cost stops when the current is turned off, and it takes only a few minutes to heat the oven after it has been standing idle.

The cost of electricity when used in the "off peak" period at Toronto, which is at night, is one-half cent per kilowatt-hour. The maximum current consumption of the electric oven was 26 kilowatt-hours and would cost 13 cents per hour when used continuously, or $1.30 for 10 hours' use. The total amount of bread turned out in 10 hours being 2,700 loaves, would make the fuel cost of 1,000 loaves 48 cents. This would show a saving in fuel over the brick oven of 41 cents per 1,000 loaves.

The labor cost was less than that of the brick oven on account of the increased amount of work turned out with the continuous baking. The saving in labor for 1,000 loaves was estimated at 22 cents per 1,000 loaves and would have been much greater if the capacity of the electric oven had been the same as that of the brick oven.

In case the bread weighed less than 1.5 pounds, the output would be greater and the amount of fuel used would be less, as the oven would not run on full heat all the time.

Taking everything into consideration, the cost of electricity at 1.5 to 2 cents per kilowatt-hour, would equal coal at $8.00 per ton, and electricity at 3 to 4 cents would equal gas at $1.00 per 1,000 cubic feet, taking into consideration the quality of gas and the efficiency of the gas ovens used.

The accompanying table summarizes the results of the tests and shows a fuel saving of 41 cents and a labor saving of 22 cents per 1,000 loaves of bread by using the electric oven.

In addition the bread baked in electric ovens has a better color and will last much longer, as it is not dried out as it is in a brick oven. The bread is absolutely clean, which is almost impossible in a brick oven where the peel sends up a cloud of dust which alights on the fresh dough as it is being put into the oven.

In the electric bakery there are no dirty coal boxes to haul around and no labor to hire to do this class of work. It is not necessary to have men stay around on days when the ovens are not being used, to give them an occasional shovel of coal, so the ovens will be ready for use. The electric oven is ready to bake in 35 minutes after the current has been turned on.

In equipping a new bakery the saving in cost of the building is a big item. Electric ovens take up one-fifth the space of brick ovens and on account of their being light in weight ordinary mill construction is heavy enough. With brick ovens, which weigh several tons, it is necessary to provide the heaviest kind of building construction. Electric ovens are also much cooler to work by, as all of the heat is applied directly to the bread and is not wasted in the work rooms of the bakery.

	Baking Space Sq. Ft.	Floor Space Sq. Ft.	Capacity 1.5-Pound Loaves	Batches Run in 10 hrs.	Output 10 hrs.	Fuel Cost 10 hrs.	Fuel Cost per 1000 Loaves	Labor Cost 10 hrs.	Labor Cost per 1000 Loaves	Total Cost per 1000 Loaves
Brick Oven	168	156	450	5	2250	$2.00	89c	$2.80	$1.25	$2.14
Electric Oven ..	81	32	180	15	2700	1.30	48c	2.80	1.03	1.51

Program of Ohio New-Business Meeting.

The next meeting of the New Business Co-operation Committee of the Ohio Electric Light Association will be held at the Algonquin Hotel, Dayton, O., on March 17. A very interesting program has been arranged which includes an address of welcome by F. M. Tait, president, Dayton Power & Light Company; a paper by E. R. Kelsey, advertising manager Toledo Railways & Light Comany, on "Central Station Advertising;" an address by R. H. Grant, sales manager National Cash Register Company, Dayton, on "Salesmanship;" paper by J. F. Jones of the Wagner Electric Manufacturing Company, St. Louis, on "Application of Electric Drive in Wood Working Shops and the Disposal by the By-Product" (illustrated); and a paper by W. H. Patterson, Westinghouse Electric & Manufacturing Company, Pittsburgh, on "Co-operation of Electric Motor Manufacturers with Central Stations to Secure Available Power Business."

In the evening the Dayton Jovian League has arranged for a big Jovian banquet and rejuvenation to be held at the Algonquin Hotel; the banquet will commence at 6:30 with President F. M. Tait of the Dayton Power & Light Company acting as toastmaster. The speakers at the banquet will be Jupiter H. E. Niesz, Jovian Order, Chicago; Col. Hard, president Ohio Electric Light Association; D. L. Gaskill, secretary O. E. L. A.; W. W. Freeman, president Union Gas & Electric Company, Cincinnati; S. G. McMeen, president Columbus Railway, Power & Light Company, Columbus; R. P. Stevens, president Youngstown Consolidated Gas & Electric Company, Youngstown; G. M. Waite, general manager, City of Dayton; F. H. Rike, president The Greater Dayton Association; E. A. Deeds, general manager National Cash Register Company, and James M. Cox, former governor.

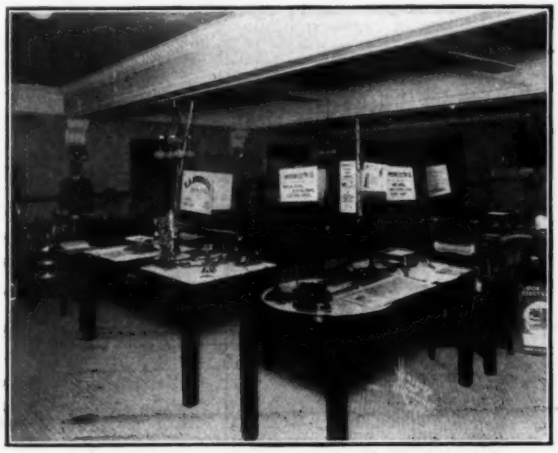
The Dayton Jovians are making great plans for this event and expect to have in Dayton for this occasion a large number of other leading officers in the Jovian Order in addition to many other notable men connected with the electrical industry. Thomas F. Kelly is in charge of the affair.

How a Central-Station Manager Keeps in Touch With His Customers.

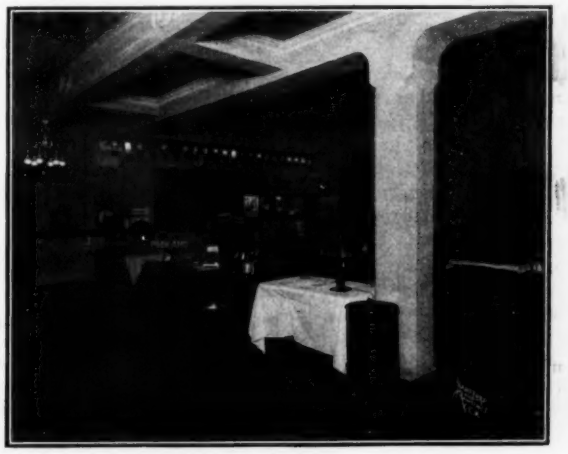
Every new customer connected with the lines of the Sandusky (Ohio) Gas & Electric Company, receives a polite note from the manager thanking him for his patronage and inviting him to notify the office promptly when anything goes wrong with his service or he encounters anything he does not fully understand. Residence customers are asked if they do not want to learn to read their meters, and an offer is made to send a man to show them how, on request. Very few customers have availed themselves of this offer. Each new customer is heartily welcomed to the "family" of the company's clientele. While the notes are similar in tone, care is taken to have enough variation of wording to relieve them of suspicion of being "form" letters.

Electric Shop Operated by Kansas Municipal Plant.

To popularize electricity for domestic purposes, such as cooking, washing, ironing, housecleaning and uses other than lighting, L. W. Chapman, commissioner of water and light for Kansas City, Kans., recently opened a municipal store in the City Hall for the sale, at practically cost, of kitchen ranges, stoves, ovens, fireless cookers and all other utensils calling for the use of electricity that are manufactured for the household. In connection with the store Commissioner Chapman also caused to be made a series of demonstrations in the homes of the city's electricity customers by which the women of the city might be educated to the use of electrical energy in the home. The result of this progressive move has been most satisfactory. While in two months only a small proportion of the 4,000 homes in which electricity is used for lighting have been supplied with



Interior of Kansas City Municipal Electric Shop.



Another View of Electrical Shop.

these devices, the educational work thus far has opened up possibilities for the equipment of hundreds of other homes, thereby assuring a large revenue to the city from the day load that hitherto has not been considered in connection with the operation of the municipal electrical plant.

The municipal electrical plant in Kansas City, Kan., has been in operation but little more than one year, yet in that time it has taken on more than 4,000 customers, and it is now delivering about 750,000 kilowatt-hours per month.

The tests made in the homes with separate meter service, have demonstrated that electricity may be used for fuel on a basis of three cents at a very reasonable cost. The city doesn't undertake to compete with 25-cent natural gas, but at the price at which it is sold, electricity is cheaper than 75-cent manufactured gas. Besides it is much cleaner and the current is always steady and to be relied upon, whereas the flow of gas, particularly in cold weather, is weak and unsteady.

One housewife with a three-burner electric range did all of her cooking and heating for washing and ironing at a cost of $2.40 a month, and a part of the electricity used was in showing her neighbors how it worked. This woman said that where a woman knew how to use it the electrical method was no more expensive than gas. Another housewife found it cost five cents a meal for cooking for a family of four, while another woman cooked for her family of three at a cost of 1 cent a meal for each person.

Company's Service Protected by Employee's Prompt Action.

Presence of mind and intelligent action on the part of Edward F. McNulty, of the accounting department of the United Electric Light & Power Company, New York City, on the evening of February 5 is deserving of special mention and should serve as an inspiration to every employee of a public service company.

McNulty had been working at the office during the evening, leaving for home about 10:00 p. m. Arriving at Forty-third Street and Eighth Avenue he found the street flooded due to the bursting of a water main in the vicinity. McNulty knew his company was supplying considerable service in the immediate neighborhood, and conscious of the damage that was possible on account of the situation, he at a great deal of personal discomfort—having to wade about almost to his knees in water—made several telephone calls and finally reached the proper man, who immediately got an emergency gang on the scene, much sooner than would have been the case had the notification been through the usual channels.

Investigation developed the fact that the transformer banks at 665 Eighth Avenue were fast being submerged, but were reached in time to take care of the exposed equipment and protect the service.

This incident has led to the issuance by the company of a telephone card, to be carried by every employee, giving the emergency telephone number of all department heads and officials of the organization. The card, which bears the caption, "For the Good of the Service," bears the following message on the reverse side, "It is hoped that every employee will find it convenient to carry this little card, which is issued as a ready reference in case of emergency. Its circulation is prompted by a suggestion of an employee alive to the company's interests.

"An opportunity may be presented at any time for you to do the company a real service by prompt notification of some difficulty, trouble or occurrence coming to your attention in your daily rounds, either during or outside of regular working hours. Your efforts will be appreciated by the company."

Must Keep Electric Signs Lighted.

Sixty-one Louisville owners of electrically lighted signs have been notified by the city engineer that they must keep these signs lighted, according to the terms of their permits, from dark until 10 o'clock every night but Sunday. A considerable disposition had been indicated on the part of merchants owning such signs to reduce their advertising costs during the slump in business by permitting them to remain dark. Louisville's regulations as to electric signs projecting over the building line are similar to those of other cities and the engineer's office has been active in checking the tendency of some of the merchants to refrain from lighting their signs at night.

Electric Vehicle Data

Meeting of Chicago Electric Vehicle Men.

At the meeting of the Chicago Section of the Electric Vehicle Association of America on March 9, Harry Salvat, of the Fashion Automobile Station, spoke on the subject of "New Ideas in Garaging Electric Vehicles." Mr. Salvat referred to the importance of proper garage service, to the development of the electric vehicle, and the need for co-operation between garage men and manufacturers and dealers of electric cars.

He thought that one of the crying needs of the industry is a standardization of batteries, so that uniform equipment could be installed in charging stations. This would not only reduce the energy loss in charging, but would so standardize the installation in various garages that boosting and emergency service could be obtained by users without restriction. He stated that there is a movement on foot at present to have tests made on batteries of various sizes to determine the size which can be most economically charged, and garage owners will advocate this size to prospective and present users.

Mr. Salvat criticised the methods of some of the local service stations of electric vehicle manufacturers, particularly the practice of sending to the user a detailed result of the inspection, and calling attention to any neglect or carelessness on the part of the garage. Mr. Salvat explained that practically without exception the garage owners of Chicago were striving to give good service, and that these reports should be submitted to the garages in which the cars are kept, so that the trouble can be remedied, and if due to negligent or careless employees, steps taken to prevent re-occurrence of the trouble. By submitting these reports to the user, who in most cases is not familiar with the details or mechanism of the car, confusion results, and often a customer is led to believe that his car is being neglected or the garage is unable to render proper service.

Mention was also made of the tendency of enthusiastic salesmen of electric vehicles to convince customers that the electric needs practically no attention and is fool-proof. These impressions usually lead to troubles, subsequently resulting in disputes between the garage and the customer, and in some cases have resulted in the disposal of the car.

General.	
Name of Company—Emergency Hospital.	
City—Washington, D. C.	Make of Vehicle—Detroit.
Business—Emergency Surgical and Medical Work.	Make of Tires—Motz.
	Size of Tires—34x3½.
Capacity of Vehicle—Four.	Type of Tires—Cushion.
	Make of Battery—Edison.
Date of Purchase—July 1, 1912.	Type of Cells—A-4.
Approximate Price—$3,500.	Number of Cells—60.
Operating Data.	
Average Daily Mileage—5.35.	Cost of Electric Power per Month—$17.00.
Daily Hours in Use—20.	Cost of Storage and Washing per Month—$20.00.
Days in Service, per Month—Continuous.	Driver's Salary per Month—$35.00.
Total Average Monthly Operating Cost (including tires, repairs, etc.) $85.00.	

The following cogent reasons for purchasing electric trucks are given in an advertisement of the United Electric Light Company, Springfield, Mass., in a local newspaper:

"High-grade electric trucks are 100 per cent faster than horses.

"From 25 to 50 per cent cheaper to operate.

"Require 75 per cent less space than horses.

"Free from war prices, disease and broken limbs.

"Sanitary, odorless, practically noiseless.

"Require minimum reserve equipment to give uninterrupted service.

"Long lived; interchangeable parts; minimum repairs; exteamster drivers; easy on tires.

"Efficient because representing a high-grade engineering product, built especially for a given task."

At a recent meeting of a local committee of the Chicago Section, Electric Vehicle Association of America, at which all electric vehicle manufacturers and dealers were represented, preliminary plans for the holding of an Electric Vehicle Salon in Chicago were discussed. A complete report will be submitted at the meeting of the Chicago Section on March 16. The consensus of opinion of those attending the initial meeting was that such an exhibition would greatly stimulate the local market.

Electrical Construction

Evolution of Concentric Wiring.

The Committee on the Wiring of Existing Buildings of the National Electric Light Association met at the Boston Edison Company's service buildings, March 5, and formulated its report. By invitation the following members of the Committee of the National Electrical Contractors' Association on Reducing the Cost of Wiring met in conjunction: A. J. Hixon, Boston; F. W. Grant, Cleveland; Paul Jaehnig, Newark, N. J.

A report on plugs and receptacles was presented by R. S. Hale, chairman of the sub-committee.

H. E. Eisenmenger presented the results of his studies of wiring costs in the United States and comparative tables of conditions in various cities were shown in proof-sheet form. These data will be incorporated in the report, together with a clear and logical outline of the evolution of concentric wiring, by S. E. Doane, as follows:

Electric wiring has been developed along two different fundamental theories. The original idea was to have a very considerable insulation which should be so strong and so substantial that every danger to life and property should be removed by the large safety factor of the insulation itself.

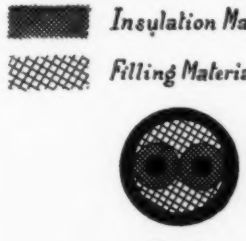


Fig. 1.

At a later time and paralleling this theory, another theory was developed along the following lines. The insulated wire is surrounded by a grounded metallic tube. In this case a very substantial and heavy insulation is no longer as essential as under the first theory. Even in case of the insulation becoming insufficient, danger to life and property will always be averted by the interposition of the grounded continuous metallic tube. In order that any danger should arise from a system of that kind, two accidental damages must occur at the same time, to wit: the ground of the surrounding conduit must be bad and the insulation of the wire must be injured. To obviate this the National Electrical Code provides that the conduit must not only be continuous from outlet to outlet, but also mechanically secured in position, and that the metal of the conduit must be permanently and effectively grounded. Furthermore, it is ruled that metal conduits must have the ends provided with bushings so as to protect the wires from abrasion.

Rule 28*f* permits, however, short sections of conduit to remain ungrounded. If in such an ungrounded section or in a conduit system the grounding of which has become insufficient, the insulation becomes bad, either by abrasion or by condensing water collecting inside the conduit, the conduit may become alive and danger to property or life may arise.

A logical step to obviate this would be to make the conduit tight-fitting with an appropriate filling material—for instance, jute—to preserve the circular section of the conduit. This close fit prevents any collection of water inside the conduit. At the same time it obviates any possibility of abrasion, the insulation and the conduit being essentially fixed in their relative positions. (See Fig. 1.) The conduit will then advantageously have a certain degree of flexibility to make insulation easier.

We thus arrive at the so-called "Kuhlo" or "Stannos" wiring systems, or rather at their first stage, with protective sheath. This variety is used where neither of the poles of the system is grounded.

In central stations with a grounded neutral wire we can go one step further. As the grounded conduit and the grounded neutral wire have no, or at least only negligible, differences of potential between each other, such as may arise from the voltage drop in the neutral wire, it evidently is unnecessary and therefore wasteful to insulate the neutral wire from the conduit as heavily as the potential wire. The insulation material used for the insulation of the neutral wire may be either saved entirely without decreasing the factor of safety (Fig. 2) or it may be put on the potential wire inside with a corresponding increase of safety (Fig. 3).

This results in a grounded continuous conduit and a grounded bare wire running inside the conduit; there is no reason why these two conductors, both grounded and both continuous, should not be united into one; in other words, why the conduit should not be used as a return circuit. The idea of using the conduit for carrying the current of the grounded return circuit is not new and has been used for many years with ordinary rigid-steel-conduit wiring. The difference between this idea and the concentric wiring is the fact that in the latter the conduit is close fitting (thus leaving no space for the accumulation of water) and flexible to a certain degree.

This is the logical evolution of the so-called concentric wire (Fig. 4). The potential conductor is surrounded by an insulating coating which in its turn is surrounded by the tubular grounded outer conductor for the return circuit. For mechanical reasons the insulating coating is covered by paper or braiding, which acts as a slip member between the insulation and the sheath in case the wire is bent.

It should not be lost sight of that this system is not a new, untried thing, but was developed five or six years ago. Many millions' worth of this material is now being sold abroad every year.

On the subject of concentric wire the problem was discussed of how to gain the approval of local inspectors. It was stated that the inspectors of Boston, Cleveland, Detroit and New York were at first opposed, but have since come to favor trial installations by responsible contractors under central-station supervision.

The American Steel & Wire Company is to make up a small lot of the wire; the B. F. Goodrich Company has offered a sample, as has the Simplex Wire & Cable Company.

In response to a question whether each manufacturer is to proceed on his own specification, it was pointed out that all samples are to be submitted to the Underwriters' Laboratories for approval.

Fig. 2.

Fig. 3.

Fig. 4.

Mr. Sargent said the General Electric Company has gotten up a complete line of fittings in model. Trial installations are being made with twist-on fittings.

Mr. Hale called attention to the fact that manufacturers will not be protected by individual patents in making up the new wires, but that central stations are bound to assure them of the large use of this type of supplies.

Members reported that the central stations of Pittsburgh and Brooklyn are ready to undertake concentric-wire installations.

On the subject of standardization of fittings, it was thought well for the manufacturers to go ahead and develop models which later may be standardized. Mr. Sargent noted the desirability

that wire be of fixed sizes and said the General Electric Company will make wire on the base of No. 14 B. & S. conductor, 0.22 inch in diameter; and it was thought desirable for other makers to work to that standard.

A model of a new type of fuse block by E. B. Latham & Company, New York, was examined. The fuses are screwed into the block, the size of base and thread admitting only the size of fuse for which the block is designed.

It was voted to approve the report of the American Society of Mechanical Enginers on the standardization of screw fittings for lamp bases.

The committee took up the recommendations of the Electrical Committee on changes in the Code and opposed those which applied to solid neutrals and opposed those pertaining to refillable fuses.

Mr. Hale presented a draft of the committee's report, which rehearses the efforts toward standardizing plugs and receptacles, the advancement of interest in concentric wiring on lines of European practice studied by Messrs. Doane and Eisenmenger, at the expense of the General Electric Company; expresses the hope that by June specimen installations will have been made, and opens up the question whether the Code should not be broadened to permit of freer experimental work, where lower cost is the aim and no added risk is involved.

Recent Developments in Concentric Wiring in Germany.

In connection with the discussions of concentric wiring in this country an article on a new type of such wire that was published in the *Elektrotechnische Zeitschrift*, Berlin, Germany, in the issue of December 24, 1914, is of timely interest.

As the imports of copper and rubber into Germany are limited during the war, the Verband Deutscher Elektrotechniker, which issues the German wiring rules, considers it advisable to use, where possible, other materials for conductors and their insulation, in order to retain copper and rubber for those purposes for which they are of greatest importance. The Verband has, therefore, provided for a new house-wiring material with paper insulation (designated by the letters "MP") with a conductor of copper, soft iron or aluminum. This wire is fashioned after the manner of Kuhlo wire or tube wire, that is, the German metal-covered insulated wire heretofore used for concentric wiring (Manteldraht, coated wire).

It is manufactured with the same minimum conducting section as heretofore, that is, one square millimeter (1,973 circular mils, corresponding roughly to B. & S. No. 17). This is surrounded by a well impregnated layer of paper with a minimum thickness of 0.8 millimeter (0.032 inch) for the smallest section and 1.0 millimeter (0.04 inch) for a conducting section of 2.5 square millimeters (4,932 circular mils, between B. & S. No. 13 and No. 14). This paper layer is surrounded by another insulating cover, which may consist of paper or of braiding of cotton or hemp or similar material. This second insulating cover has a thickness of not less than 0.6 millimeter (0.024 inch) and in case of several conductors being inside the outer metal cover it may be common to all inner conductors. After this the wires must be carefully dried and the paper well impregnated by a tough impregnating material, which does not become brittle. The outer cover is a tightly fitting metal coat (not of lead) with a minimum thickness of 0.25 millimeter (0.01 inch) and protected against rust. The outer cover may or may not be used to carry the return circuit.

The finished conductor must withstand 1,200 volts between the conductors and also between conductors and the metal cover for half an hour. The carrying capacity for copper, aluminum and iron conductors is stipulated for instance, as follows:

Cross Section.		Maximum Permissible Permanent Current in Amperes.		
Squ. Mm.	Cir. Mils.	Copper.	Aluminum.	Iron.
1.0	1,973	11	8	4
1.5	2,960	14	11	5
4.0	7,892	25	20	10

The nearest B. & S. sizes to these are: No. 17-2,048 circular mils; No. 15-3,257 circular mils; No. 11-8,234 circular mils.

The committee reserves the right to recall these rules after the war, but the committee is of the opinion that *the qualities of MP wires are such that they probably later will be permanently permitted.*

Utah Contractors Dine.

The Society of Electrical Contractors of Salt Lake City held its annual banquet and ball at the Commercial Club on February 27. The decorations used at the banquet were among the most original and unique ever used at such a function. The tables were set in the form of a hollow square. From a huge pedestal in the center streamers of incandescent lamps led to each corner of the table. Woven into the floral decorations of the table were hundreds of tiny incandescent lamps representing fruits and flowers.

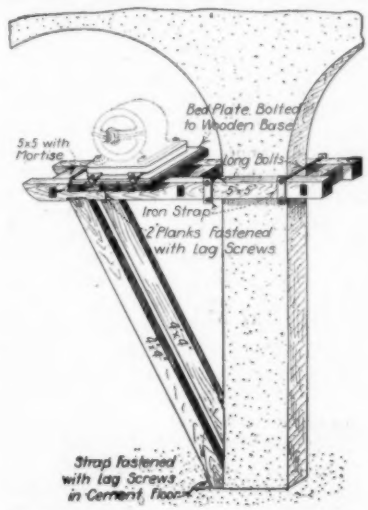
S. Z. Gwaltney presided as toastmaster. C. B. Hawley, J. V. Buckle and J. G. Guiver responded to toasts. The members of the electrical fraternity had their wives or sweethearts as guests, and after the banquet dancing was the order of the evening.

Mounting Motor in Concrete Building.

The accompanying sketch illustrates a method recently used for mounting motors in a textile mill.

The mill was built of reinforced concrete, and the columns were 17.5 feet apart. Two looms were placed in each bay with the fronts facing each other and the backs to the columns. The inserts in the ceiling were set for the looms and the shaft at the end only.

The space was practically filled up and it would be dangerous and not desirable to run the belt between the fronts of the two looms owing to the weavers working under it and around it, so we designed the platform as shown. This platform is used for 5-horsepower motors and can be used up to 7.5 horse-



Motor Mounting on Concrete Column.

power easily. The frame is made to fit snugly around the columns and is pulled up tight with the iron clamps. The motor is easily accessible by using a step-ladder.

William T. Estlick.

Licensing and Inspection Proposed in Iowa.

A bill is pending before the Iowa Legislature which provides for the regulation and licensing of electricians and electrical contractors by municipalities, and for the appointment of a chief state electrical inspector at a salary of $1,800 per year.

The measure gives cities and towns the right to prescribe rules and regulations for the installation of electrical light and power wiring and electrical fixtures and appliances.

The state fire marshal is empowered to employ a first-class practical electrician to be known as chief electrical inspector and such assistants as are necessary, from a list of those who have passed a favorable examination

before an examining board, composed of one member from the Electrical Workers' Union, one from the Iowa Electrical Contractors' Association and one from the Underwriters' Association.

The examining board is called upon to formulate such rules and regulations necessary for standardizing, proper installation and inspection of electrical wiring.

The state fire marshal is given jurisdiction over city and town electrical inspectors or inspection boards and shall have the right to determine all matters brought to his attention by any party in interest. His decision will be final.

A similar measure has been proposed in Wisconsin, but with the substitution of local boards and officials for the state board.

Among the Contractors.

An important electric wiring contract will be let this spring in Dodge City, Kans., in connection with the building of a $90,000 theater by Merritt and Otero Beeson. The showhouse will be one of the most costly in Western Kansas. It will be known as the Beeson Theater.

A new electric, contracting and repair shop has been opened in Greenville, O., by George Murphy, who has been with the Greenville Home Telephone Company for the past 15 years as wire chief, and L. C. Warner, who has been superintendent of the New Madison Lighting Company, New Madison, O. The name of the new firm is "The Electric Shop." Both of the men are live wires and they will do all kinds of electric repair work, contracting, storage-battery charging and repairing. They have installed equipment for taking care of storage batteries and magneto work. The firm is located at 141 East Third Street.

The Watson-Flagg Engineering Company, of New York City, has been awarded the contract for the complete electrical work in the new $500,000 high-shcool building at Allentown, Pa.

Rudolph Schmidt, Rochester, N. Y., has been elected by the state association as national director of the National Electrical Contractors' Association of the United States.

Frank N. Hurd, of Mankato, Minn., has purchased a two-story building at 126 Jackson Street and will shortly move his store and shop to that location. The move was necessitated by the rapid increase in his business.

O. G. Pack, secretary of the Kansas City Electrical Construction Company, Kansas City, Mo., reports a large volume of contracts being let and in sight for moderate-sized work, but a comparative dearth of big work. There are many tracts being improved with one and two-story buildings in Kansas City this spring—business blocks, many of which may later receive more stories. Some of these buildings are going up in the downtown business districts where larger structures might under ordinary circumstances be erected.

The Home Electric Company, composed of Roy Katterjohn and Will Smiley, has opened for business in Paducah, Ky. Temporary headquarters have been occupied on Broadway, between First and Second Streets. The company will do general electrical contracting.

The Royal Electric Company announces the removal of its shops from its Philadelphia office at Thirteenth and Race Streets to 15 South Second Street, Hammonton, N. J. This company, of which F. L. Jackson is manager, undertakes repairing, testing, engineering contracting, switchboard building and merchandising of electrical material.

The Jefferson County Electric Company, with an authorized capital of $5,000, has been incorprated at Louisville, Ky., to do an electric contracting business. The incorporators are J. A. Jakoby, Hoke Smith, John F. Boysen and Allen E. Smith.

The contract for wiring and lighting the Coca Cola Building, a new twelve-story concrete structure in Kansas City, Mo., has been let to the Squire Electric & Construction Company, of Kansas City.

George E. Shepherd, of Shepherd & Rust, Wilkes-Barre, Pa., national director from Pennsylvania of the National Electrical Contractors' Association, has been made chairman of the Publication Committee of the Association, to fill the vacancy caused by the death of Marshall L. Barnes.

The Harry I. Wood Company, Louisville, Ky., has just completed the contract with the state of Kentucky covering the wiring of the old state capitol and executive building; also the installation of seven outdoor standards and a transmission line. The wiring in both buildings was installed in iron conduit, the floors being taken up wherever possible and concealed therein. Where this was not possible the wire was installed in metal molding. The seven standards were each equipped with a 750-watt type C lamp. Safety steel-taped, duplex cable was used for the underground construction feeding these standards. The transmission line consisted of 1,600 feet of 4/0 duplex, steel-taped cable, laid underground from the switchboard in the penitentiary engine room to the service switch in the basement of the executive building. The old gas fixtures in the above buildings were wired and equipped with clusters and 16-inch opal shades.

Work has just started on the Old University Hospital Building, which is to be remodeled and used as a school building. The contract covers the installation of electric light and power wiring, magneto clock system, program bell system and intercommunicating telephone system. The company has also closed a contract covering the new Emmet Field School at Crescent Hill.

Work on a three-phase motor installation for the cooperage plant of J. Schwarzwalder & Son has been completed. This installation consists of 21 motors ranging in size from 5 to 50 horsepower. All wiring is in conduit, and all motors are grouped on six sets of feeders.

This company now has a contract for the installation of the White Way in the City of Lexington. This White Way will consist of 97 two-light standards, each standard to be equipped with Novalux compensating fixtures and 300-watt, 20-ampere, type C lamps. These 97 standards will be divided on three 2,300-volt series circuits, each circuit controlled by a 6.6-ampere secondary regulator located on one of the Kentucky Utilities Company's poles. Two of these circuits will control all standards which will burn until midnight, the other being used for the standards which will burn all night. The wiring for these standards will be underground, No. 6 steel-taped cable designed for 4,000 volts working pressure being used. There will be a positive cutout in the base of each standard to control same. This installation covers the taking up and relaying of about two miles of street.

Electrical Show at University of Illinois.

On April 8 to 10 next the Fifth Biennial Electrical Show will be held at the University of Illinois, Urbana, Ill. This biennial event is under the auspices of the Electrical Engineering Society of the College of Engineering. Twenty-five thousand square feet of floor space are available and three-fourths of this was assigned by March 1. The electrical manufacturers are giving their unqualified support and over fifty concerns will be represented by exhibits and each exhibit will be fully explained by capable men. The remaining booths will display local and student exhibits.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Aid to Fixture Work.

In fixture work much time may be saved by use of the following device. On a flat surface, of say, 24 inches draw concentric circles, starting with one-inch radius and increasing radius by one-half inch until space is covered. Then using center of circle as point of intersection, divide outer circle into two, three, four, five and six equal parts. Draw lines from center to all points on outer circle. Mark triangle as 3 3 3, square 4 4 4 4, pentagon 5 5 5 5 5, hexagon 6 6 6 6 6 6. (See illustration.)

Now in laying off a fixture body ring, a canopy, a ceiling plate, etc., proceed as follows. For example, to punch twelve-inch ceiling plate for three lights, lay plate on circles, inverted, having outer rim equidistant to nearest circle mark on

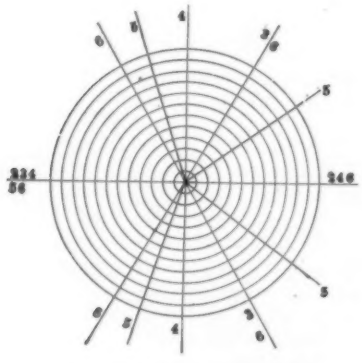


Diagram for Fixture Work.

plate. The intersection of lines marked three, gives location of lights. This device may be used for almost any kind of parts and in numerous combinations. The one described here will handle parts from 2 to 24 inches in diameter, in two, three, four, five or six divisions.

Robert Oster.

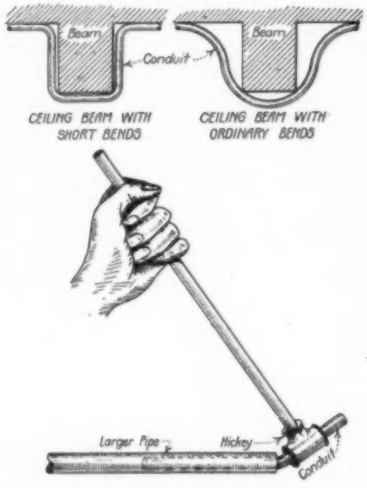
Fastening Stud Boxes on Laths.

At times one has great difficulty in getting a solid hold with a stud box on laths. This is caused by the wood screws splitting the laths. I overcome this trouble by using a toggle bolt in addition to one wood screw. This slides in between two laths and when it turns it draws the box up to the laths.

Joseph B. Josephson.

Making Sharp Bends in Conduit.

When making a bend in a piece of conduit with a hickey, it is hard to make a bend shorter than nine inches. By the use of a piece of pipe of larger size than the piece to be bent, however, it is possible to make a bend as short as may be desired. This is shown in the accompanying illustration. Such



Sharp Bends in Conduit.

bends are especially desirable when a run of conduit is to be fitted around a beam which protrudes from the ceiling, and in other similar positions. Small conduit need not be more than 1.25 inches from the beam at the bends.

A. A. Vilter.

Visible Telephone Signal.

Owing to the noise in the power house it was nearly impossible to hear a telephone extension bell if any distance from it, so I used the following scheme.

I removed the two gongs and attached a strip of copper to the clapper, insulating it from the same. To this strip one leg of a 110-volt lighting circuit was attached; the other leg was attached through a lamp to two contacts screwed to the door of the telephone box, one on each side of the clapper. When the telephone rings the clapper makes contact with the two contacts, causing the lamp to flicker, thus attracting the attention of the operator.

R. F. Cooke.

Pump Leathers for Gasoline Torches.

Take a piece of seven-eighths-inch brass casing a few inches long and ream one end to form a funnel-shaped opening. Cut another piece of three-quarter-inch casing about one-quarter inch long and file the rough edges so as not to cut the leather. Lay the three-quarter casing on the bench and a piece of thin old-soaked leather over it, then push the seven-eighths-inch casing over it to form a drum-head. Trim the leather even with the end of the casing and let it form for a few hours, at which time you will have a nicely shaped leather cup. A hole punched in the center of the cup will finish the job. As gasoline dries out the leather very quickly, soapsuds should be used thereafter to keep the leather soft.

Joseph Braith.

Bit Extension for Fixture Plug.

Progressive communities are rapidly discarding gas and combination fixtures for "straight" electric. In a great many cases in order to save the price of an insulating joint and deep canopy, the pipe nipple and cap are replaced by a plug in the elbow, thus leaving the ceiling or wall clear for the use of the crowfoot. For inserting the plug, socket wrenches are not practical as they are generally too short and do not hold the plug sufficiently tight. The accompanying illustration shows the use of a regular bit

Bit Extension.

extension which meets all requirements in a very satisfactory way, being adjustable to the different sizes of plug and always ready, as these extensions are a part of every up-to-date wireman's kit.

Oscar D. Morse.

Catching Plaster and Dirt.

I find by using a cake form, such as is used for baking cakes, attached to a brace and bit, while boring through ceilings, all the fine plaster and dirt which otherwise would fall on the floor is caught. I consider this superior to a funnel for this purpose.

Lysander C. Beverly.

Public Service Commissions

Conducted by William J. Norton

ARIZONA.

The Second Annual Report of the Arizona Corporation Commission has been issued, covering the period from December 1, 1913, to June 30, 1914. The orders on formal and informal case rendered during the period are given in the report.

CALIFORNIA.

Destruction of Company Records. In denying the application of the Los Angeles Railway Corporation and the City Railway Company, of Los Angeles, for authority to transfer their property to the Los Angeles Railway, and the accompanying application of the latter company to issue bonds and common capital stock, the Commission states in its order that many important books of the predecessor companies bearing on the valuation of property were destroyed, in order to avoid a public revelation of their contents. The Commission, in its investigation, found itself hampered by the absence of these books. The decision says: "The explanation was made that these books had been burned, as it was thought their usefulness had ended. This does not appear to us to be a valid explanation, and we have no hesitancy in rejecting the excuse that these books would be no longer useful. Any man who has served a big public corporation as long in an official capacity as have certain of the officials of those applicants either did know or ought to have known the extreme importance of preserving corporate records. I think the conclusion justified, therefore, that these books were either destroyed or allowed to be destroyed in order to avoid a public revelation of their contents."

The Commission found that the value of the property is not equal to outstanding bonds, and the application is denied. The order provides that the companies may submit a modification of the present application at a later date.

Southern Sierras Power Company was provisionally authorized to issue $300,000 of its six-per-cent 25-year bonds. In making the investigation to determine whether or not there was a proper basis for the issue the Commission found that a close relationship, amounting to a practical identity of control, existed between the Southern Sierras Power Company, Nevada-California Power Company and the Sierras Construction Company. It further developed that the properties of the Southern Sierras Company were built by the Sierras Construction Company, under contracts by which the power company paid the full cost of the work and an added 15 per cent as a profit to the construction company.

In regard to the relations existing between the companies the opinion says: "In view of the situation herein found to exist, we recommend that a final order be granted to this applicant to issue bonds, only after it shall have adjusted its accounts with its affiliated and associated corporations, to the end that any profit heretofore made or proposed to be made by any such affiliated or associated corporations at the expense of this applicant be eliminated. It is not necessary here to comment upon the practice of permitting a construction company to profit at the expense of a public utility, when that construction company is owned or controlled by the same interests which own and control the utility. The practice cannot be defended, and the recommendation herein made will suggest that bonds be authorized only after the proper adjustments have been made, to give to this applicant the benefit of all that rightfully belongs to it."

The Santa Barbara Gas and Electric Company was authorized to issue $100,000 of six-per-cent 30-year bonds, to be used in retiring promissory notes amounting to $38,000 and for additions and betterments in the sum of $62,000. The bonds must be sold to net the company 95 per cent of their par value, plus accrued interest.

ILLINOIS.

The Commonwealth Edison Company was authorized to issue $10,000,000 of bonds secured under the corporation's general mortgage. The additional securities will be issued shortly for the purpose of reimbursing the company's treasury for something over $6,500,000 expended for improvements, and to supply funds of approximately $3,500,000 to meet the requirements of the current year's improvement budget. There are now outstanding $24,000,000 of these five-per-cent first-mortgage bonds.

INDIANA.

Indeterminate Permit. A bill has been introduced in the Indiana Senate to extend the time from July, this year, to July, 1917, in which public utilities may elect to surrender their local franchises for state indeterminate permits.

NEW HAMPSHIRE.

The Grafton County Electric Light and Power Company. The Commission has issued a supplementary order upon the application of the Grafton County Electric Light and Power Company for leave to take over the properties of the Lebanon and Mascoma electric companies which operate in Lebanon and Hanover. In a prior report the Commission refused to assent to the proposed transfer, upon the ground that the price at which the properties were to be taken over and capitalized was in excess of their fair value.

The case was appealed to the Supreme Court, and the court held that it was unnecessary to consider the question of capitalization, until the question of the public good involved in the consolidation has first been decided. In its supplementary report the Commission says that there is no evidence to support a finding that this transfer will be for the public good, but that there is evidence to the contrary. The opinion says that the proposition to which approval is asked is a *capitalization pure and simple*, the sole purpose being to issue a much larger volume of securities than is now outstanding without increasing the value of properties devoted to public use, the new securities to be sold to the public.

"It is in the public interest that the capitalization of public service properties shall not be increased for mere purposes of private gain. If these properties are merged in a new corporation, at their full present value, the capitalization outstanding against them will be largely increased, without in any way increasing the value or efficiency of the properties. We believe it to be undesirable that governmental sanction shall be given to the buying up of public utility properties which have accumulated a surplus out of rates paid by the public for the purpose of merging them into a new corporation and capitalizing the aggregate existing surplus. If we have the right, on the ground of public policy, to refuse our assent to such a

merger, then we find that the proposed consolidation is contrary to the public good and ought to be denied on that ground."

The case is still pending in the Supreme Court, which will now be called upon to determine whether the Commission has the right under the law to refuse approval to the transfer for the reasons stated in its report.

NEW YORK.

Investigation of Commission. The Legislative Committee which was appointed to investigate the New York Public Service Commissions has apparently completed its investigation of the First District Commission, and is proceeding to hold hearings in the investigation of the up-state Commission. Its report to the governor and the Legislature on the testimony and findings which concerns the First District Commission has not as yet been made public.

The New York Telephone Company has submitted to the Public Service Commission a new schedule of telephone rates for New York City, which provide a reduction in the company's income of approximately $2,700,000.

The company asked for a valuation of $84,000,000. The valuation prepared by E. W. Bemis for the joint legislative committee on telephone rates, fixed the value of the company's property at $65,000,000. The Commission placed a value of $82,000,000 on the company's property, and held that eight per cent is a reasonable return on the company's investment. The company was invited to submit a schedule of rates which would bring its net earnings down to that figure.

The contending parties have come to a practical agreement, and hearings have been indefinitely postponed. The rates offered by the company practically satisfy the demands made during the past investigation. It is expected that an order will be issued shortly and the Commission has specified July 7 as the date upon which the reductions in rates will take effect.

The Northern New York Power Corporation received authority to issue $900,000 of its six-per-cent first-mortgage bonds at not less than 97 to net $873,000, and also to issue $500,000 capital stock. Three hundred and fifty thousand dollars of the proceeds from the sale of the bonds and the entire stock issue at 125, will be used in payment for the water rights and property of the Columbia Mills, and the remaining $455,000 from the bonds will be expended in completing the company's hydroelectric development. The Commission further approves the lease of the new company's thus acquired and developed hydroelectric property to the Niagara, Lockport & Ontario Power Company, of Buffalo, N. Y.

In approving the franchise for the delivery of the new electric power to the Niagara, Lockport & Ontario system and the furnishing of the same to the Columbia Mills' present customers, the Commission compels the companies to stipulate that they will not interfere with the business of the Peoples Gas & Electric Company, which is serving the people of Oswego.

OKLAHOMA.

El Reno Gas and Electric Company. The city of El Reno entered a complaint alleging that the company's present rate for gas is unreasonable.

The Commission finds, after investigation, that the present rates do not produce a net revenue greater than is necessary to care for proper depreciation and interest on investment, and the complaint is dismissed. The Commission, however, makes the following comment: "Regardless of whether the rates produce a sufficient revenue to pay an income on investment, they may be unreasonable. When a plant is not making a sufficient revenue to pay depreciation and interest on the investment, it should be permitted to charge any reasonable rate that will produce the greatest net revenue. We have some doubt as to whether the rate in El Reno does, in fact, produce more net revenue than a lower rate would produce. If the rate were only two-thirds of what it now is, the consumers would consume more gas, and there would be more gas consumers. If an increased number of consumers and the distributing of an increased amount of gas would not require the facilities to be extended, it would doubtless have the result of producing a greater net revenue. However, this is problematical, so far as the record in this case is concerned, and is only mentioned here as a suggestion."

WISCONSIN.

The Bloomer Electric Light and Power Company. The applicant, L. P. Martiny, alleges that the Bloomer Electric Light and Power Company has unreasonably refused to reinstate light and power services on his premises. The applicant had been supplied by means of a transformer installed by the company just outside consumer's premises, and by wiring constructed at the consumer's expense. No lightning arresters were installed, the president of the company having assured Mr. Martiny that such installations were unnecessary. The transformer was burned out, presumably as a result of an electric storm, and the applicant has since been without service. The company insists that the applicant bear the cost of the new transformer and of lightning arresters.

The Commission says: "It is the duty of a public utility supplying electricity for light and power to provide such devices as are necessary for the reasonable protection of its customers and the public. In Columbus R. Co. v. Kitchens, 83 S. E. 529, the Supreme Court of Georgia holds in substance that where an electric light company maintains overhead wires from its plant to a residence of one of its patrons for the purpose of supplying light to the house, the company is under duty to employ such approved apparatus in general use as will be reasonably necessary to prevent injury to the house or persons or property therein arising from electricity, which may be engendered by a thunderstorm, and strike the wires and be conducted thereby into the residence. The same court in an earlier decision, Heidt v. Southern Teleph. & Teleg. Co. 122 Ga. 474, 50 S. E. 361, used the following language: 'Persons or companies operating telephone and electric light systems for the transmission of electricity upon and over public highways owe to the public the duty of properly constructing and maintaining their respective wires and poles; they are bound to provide such safeguards against danger as are best known and most extensively used, and all necessary protection must be afforded to avoid casualties which may be reasonably expected.'

"In Wisconsin this duty does not extend to apparatus which is situated on the premises of the consumer, since Sec. 1797m-90 of the Statutes exempts utilities from the requirement of installing on consumers' premises any part of the facilities incident to service, except meters and appliances for purposes of measurement.

"In the present case the transformer is not located on the premises of the consumer, and it is the usual practice to install a lightning arrester on the same pole as the transformer. Such installations are necessary for the reasonable protection of the consumer and his property from electric storms, and from the current carried by the high-voltage transmission line. Had the lightning arresters been installed when the line was originally constructed, it is probable that the transformer would not have burned out. Under such circumstances, it is unreasonable to require the consumer to bear the expense of installing a new transformer and the necessary lightning arresters. Such devices should be furnished by the utility and maintained by it."

The company is ordered to reinstate electric service to the applicant and furnish and maintain at its own expense such transformers, lightning arresters, and other equipment as are necessary to supply such service in a reasonably safe and reliable manner.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 263.—Rewinding Motor.—I have a series motor running at 1,100 revolutions per minute that I want to have run at 1,700 revolutions. I would like to know whether to rewind the armature alone or to rewind both the armature and fields. At first I intended to rewind only the armature and connect the fields in multiple, which it seemed to me would answer the same purpose as rewinding the fields; then I thought I would find out what other readers suggest.—J. B., New York, N. Y.

No. 271.—Three-Phase Distribution.—Under what conditions is it preferable for a central station to distribute three-phase, four-wire, and when should three-phase, three-wire be used, 2,300 volts being assumed in either case?—P. E., Wheaton, Ill.

No. 272.—Electric Shock.—In the case of electric shock, which is more dangerous, (a) direct current or alternating current, (b) high frequency or low frequency, (c) high voltage with small current or low voltage with large current?—T. J. S., Butte, Mont.

No. 273.—Talking Sign.—What length of exposure is regarded as best for the successive flashes of an electric talking sign in which the words are flashed on one at a time?—B. F., Chicago, Ill.

Answers.

No. 262.—Electrically Driven Street Sweeper.—Has any electrically driven suction street sweeper ever been tried out by any municipality or street-car company?—F. N. S., Toronto, Canada.

Electrically driven street sweepers are successfully used in Berlin, Germany, and some other European cities, I understand, but whether they are of the suction type I am not informed. I do not believe street railways have ever given the suction sweeper a fair trial because of unwarranted fear of using much power. A well designed suction sweeper should be able to keep a track practically free from dust, if used once or twice a day, depending on the amount of dirt thrown on the track by horses and by vehicle wheels from muddy cross streets. They should decrease or almost eliminate the need for sprinkling the track and greatly increase the pleasure of using street cars substantially free from the filthy dust now common on city streets. If tracks are frequently swept, the power required to operate a suction track sweeper is

Fig. 1.—Gas-Electric Suction Street Cleaner.

not heavy. Having the power available, the track sweeper should be the first type of electric suction street cleaner to come into extensive use. The many advantages of suction street cleaning over old methods of street sweeping are so marked and so evident that they need not be referred to here. From the standpoints of sanitation and efficiency alone the suction street cleaner is as superior to the old hand broom and mechanical dirt-throwing broom sweeper as the vacuum carpet cleaner is to the household broom and carpet sweeper.

Fig. 2.—Dirt Box Being Dumped; In This Case Hauled to Dump by Cleaner.

A new type of suction street cleaner, in which the drive is of the gas-electric type, has been brought to my notice. Several views of the larger size of this machine are shown herewith. This type of machine consists of two parts. The forward part carries a four-cylinder gasoline engine constantly driving a generator; the propelling, driving of the broom and suction fan is by means of electric motors; all this equipment, together with the control is on the front part. Acting also as a tractor, this part pulls the three-wheeled trailer on which is the dirt box, with a capacity for about six cubic yards of street dirt. When full the trailer can be detached and hauled to the dump by a simple power tractor or by a team of horses. An empty trailer is then attached and sweeping continued. The cleaning capacity of this size of machine is 12,300 square yards per hour. A smaller machine in which the dirt box is not detachable is also made for use on business streets during the day where dense traffic makes hand sweeping hazardous and ineffective.

Fig. 3.—Cleaner Detached from Dirt-Box Trailer.

In a recent test in Sandusky, O., in cleaning an asphalt pavement of the entire winter's accumulation, the machine swept up an average of about 18 cubic yards of dirt per mile length of 30-foot pavement. At each dumping the dirt box contained about four cubic yards of heavy material, averaging 2,040 pounds per yard, and about one cubic yard of dust as fine as flour; the latter is deposited in a separate compartment known as the dead-air chamber. Other tests were made on a brick pavement six blocks (about one-half mile) long and 40 feet wide; two of these blocks were old pavement, uneven and full of holes; two blocks were fairly smooth, but with sand filler between bricks; two blocks were modern with cement filler between bricks. On the first sweeping an average of about three-fourths cubic yard was picked up for each of the six blocks, or 4.5 cubic yards total. A second sweeping two days later (without any intermediate attention) picked up a total of 1.75 cubic yards for the six blocks. A third sweeping on the following day picked up 0.75 cubic yard total; after this sweeping a person could draw his hand over the pavement without finding any indication of dust on the hand.

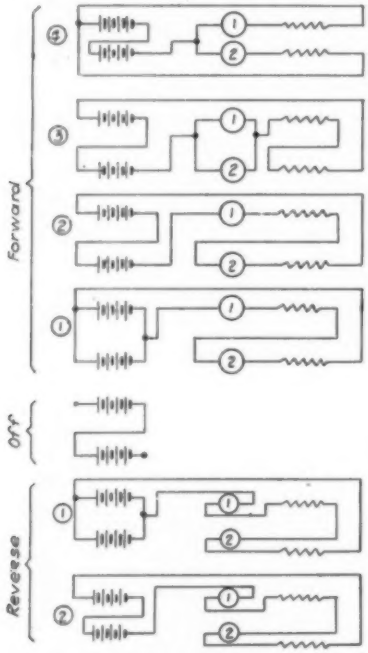
The trailing dirt box can also be replaced by a watering tank and, if desired, the brush can be removed and a squeegee attached to scrub the streets. Ordinarily no sprinkling is need with suction street cleaning. Where the pavement is very uneven, a helper can accompany the machine, as shown in Fig. 1, to sweep out by hand deep ruts and holes that the flexible rotary brush cannot reach. He can also pick up loose bricks, stones, or other heavy litter, depositing this material in a special receptacle on the front end of the dirt box. These machines are manufactured by The Way-Cleanse Company, Sandusky, O. Electrical equipment on the machines is of General Electric make. The Way-Cleanse Company is preparing to build these cleaners also for street-car use; the dirt box in this type will have a much larger capacity.—F. B., Chicago, Ill.

No. 265.—Electric Vehicle Control.—In the older types of electric vehicles it

used to be the custom to connect up the battery in some sort of series-parallel arrangement, I believe, which was claimed to be very efficient. Is this system still used to any extent and, if not, why not? —J. T. S., Yonkers, N. Y.

It is quite true that the older types of electric vehicles used a battery connected in series-parallel and even at this late day a few makes of passenger cars and of the small industrial trucks designed for indoor work in freight terminals, factories, railway depots, etc., still retain the series-parallel control. But the straight series control is now found in the majority of the modern electrics.

In a series-parallel system used on a number of the old trucks, the battery was arranged in two sections and the connections gave four speeds forward and two reverse. The two sections of the battery were connected in parallel on the



No. 265.—Former Scheme of Vehicle Control.

first speed forward, while the fields and armatures of the two motors were in series across the battery. On the second speed the two battery sections were in series with motor armatures and fields. On the third speed the motor armatures were connected in parallel, while on the fourth the armature and field of each motor were in series, but were connected in parallel across the complete battery. The battery was connected in series on the "off" position, and the two reverse speeds were similar to the first and second forward except that the armature current was reversed.

With the control just described the battery was in parallel only on the first position, which was used mainly for starting. A variation of this was the control in which the battery was connected in four parallel groups for starting, in two parallel groups on the second speed and series for the final speed. The motor and fields were always in series. In others the half voltage obtained with the two parts of the battery in parallel was used continuously for low speeds.

But about ten years ago the straight series control began to be adopted even before the single motor equipment had been standardized. This control is distinguished by its use of a resistance for starting and for changing connections. A single motor has its fields arranged so they may be connected in either series or in series-parallel. The resistance is cut out on the first two speeds, leaving the fields in series on the third speed. On the fourth speed resistance is connected in circuit in order that the change to the fifth may be made, and the fields are then connected in series-parallel.

Inasmuch as both types of control are still in use, it may be of interest to compare the two. The strongest argument in favor of the series-parallel control is the fact that no starting resistance is required and consequently there is no loss in heating the rheostat. On the other hand, the parallel connection of the battery is a disadvantage because of the liability of cross currents between the two sections. The motor is usually wound for full battery voltage and operates at low efficiency on half battery voltage. The starting may be jerky because of sudden doubling of voltage.

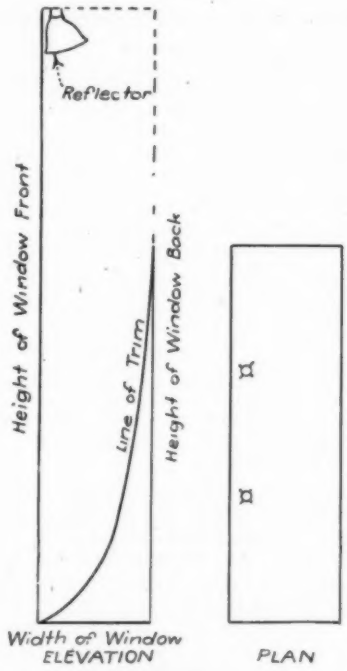
It is sometimes difficult to arrange connections to the ammeter or ampere-hour meter so all currents will pass through the instrument properly. The meter must be connected across the smallest battery section which is discharged in parallel, and then there will be no chance of putting in 100 ampere-hours and taking out (neglecting losses) 200 ampere-hours.

In the effort to intensify the strongest feature of the electric, its simplicity, the straight-series control has naturally come into wide use. The battery is always in series, and there is no possible chance of one-half of the battery deteriorating at the expense of the other half. The motor is operated at its proper voltage. The controller and the wiring are simplified to a considerable degree. When all these factors are considered, the reason for the wide use of series control in preference to the series-parallel is obvious.—R. E. P., Brooklyn, N. Y.

No. 266.—Lighting Shallow Window. —Is there any way of lighting uniformly the rear display surface of a show window only 14 inches deep, 4 feet wide and 6 feet 6 inches high?—M. P., South Bend, Ind.

The height of the window back is not given. Assume it to be 4 feet. This gives an area of the surface of trim of about 4×4.5=18 square feet. Also assume an illumination intensity desired of 20 foot-candles and an efficiency of utilization of 0.45, a light-colored background being used. Then 18×20=360 effective lumens required. This can be easily supplied by two 60-watt Mazda lamps with X-Ray reflector No. 730 of the hood type. Such an equipment installed in the manner shown will give approximately 27 foot-candles per square foot, a little higher than specified but none too high for effective advertising purposes.

If the height of the window back is altered, this would alter the total effective lumens required. To allow any calculations to be made in the event of this height of back being other than four feet, there are given the following data for lamp-lighting deliveries at an efficiency of 0.45 : 25-watt tungsten lamp, 105 lumens; 40-watt tungsten lamp, 171 lumens;



No. 266.—End Elevation and Plan of Window.

60-watt tungsten, 265 lumens; these values are based on the use of Mazda lamps of the latest type and the highest efficiency attainable for these sizes.—R. T., New York, N. Y.

No. 269.—Changing Over Fan Motor. —I have an 8-inch, 110-volt, direct-current, Western Electric fan motor which I would like to change into an alternating-current motor to run on 110 volts, 60 cycles. Can this be done and, if so, how? —C. G. L., Minneapolis, Minn.

An eight-inch, 110-volt, direct-current Western Electric fan motor may be operated on alternating current of 110 volts, 60 cycles, without any change whatever, as it is a series-wound fan. The fan will operate at approximately the same efficiency and speed as on direct current.—E. J. R., Brooklyn, N. Y.

Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

DIRECT CURRENTS.

Problem 27.

A 25-horsepower, 230-volt, four-pole, lap-wound, shunt motor takes a current of 8.3 amperes from the line at no load and runs at a speed of 1,200 revolutions per minute when the field current is 2.5 amperes. The air-gap flux for any magnitude of field current is given in Fig. 25; curve A being for an armature current of 5.8 amperes and curve B for an armature current of 90 amperes. The armature resistance (hot) is 0.12 ohm.

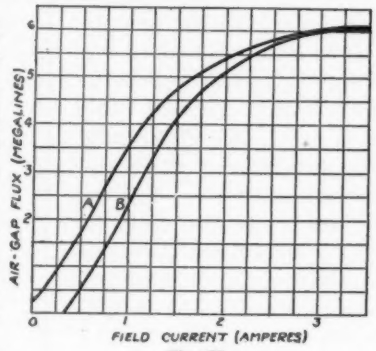


Fig. 25.

The field current being maintained constant at 2.5 amperes throughout, find the armature speed under the following conditions: (*a*) terminal voltage, 230 volts; armature current, 90 amperes; (*b*) terminal voltage, 230 volts; armature current, 5.8 amperes; a resistance of 0.5 ohm connected in series with the armature; (*c*) terminal voltage, 230 volts; armature current, 90 amperes; a resistance of 0.5 ohm connected in series with the armature; (*d*) terminal voltage, 235 volts; armature current, 5.8 amperes; (*e*) terminal voltage, 235 volts; armature current, 90 amperes; and (*f*) terminal voltage, 230 volts; armature current, 5.8 amperes; and the armature wave-wound with same number and size of conductors as when lap-wound.

SOLUTION OF PROBLEM 27.

We have seen (Equation 29) that the armature voltage (E_a) of a dynamo is given by

$$E_a=p\Phi Z(r.p.s.)/p'10^8$$

Transposing, the speed in revolutions per second (*r.p.s.*) is given by

$$r.p.s=E_ap'10^8/p\Phi Z$$

Expressing the flux (Φ) in megalines and the speed (S) in revolutions per minute we have

[44] $$S=E_ap'\times6\times10^8/p\Phi Z$$

Since the number of poles (p), the number of paths between brushes (p') and the number of armature conductors (Z) are constant for any given machine we may represent the expression $p'\times6\times10^8/pZ$ by a constant (K) and write

[45] $$S=KE_a/\Phi$$

the armature voltage (E_a) being measured in volts and the air-gap flux (Φ) in megalines.

Answer to Question a.

The line current at no load being 8.3 amperes, the armature current (I_a) at no load is given by [13]

$$I_a=8.3-2.5=5.8 \text{ amperes.}$$

The armature voltage of a motor is given by [3] or $E_a=V_t-I_aR_a$. Hence at no load,

$$E_a=230-5.8\times0.12=229.3 \text{ volts.}$$

The air-gap flux (Fig. 25, curve A) corresponding to a field current of 2.5 amperes is 5.8 megalines. The speed at no load being 1,200 revolutions per minute, the constant (K) may be evaluated by substituting the known factors in [45]

$$1{,}200=K229.3/5.8$$

and K equals 30.4. Under the conditions of Question (*a*)

$$E_a=230-90\times0.12=219.2 \text{ volts.}$$

The air-gap flux from curve B, Fig. 25, equals 5.7 megalines. Hence from [45],

$S=30.4\times219.2/5.7=1{,}169$ revolutions per minute.

Answer to Question b.

The armature resistance being increased to 0.5+0.12 or 0.62 ohm, the armature voltage by [3] is

$$E_a=230-5.8\times0.62=226.4 \text{ volts}$$

Hence the speed by [45] is

$S=30.4\times226.4/5.8=1{,}187$ revolutions per minute.

Answer to Question c.

The armature voltage by [3] is

$$E_a=230-90\times0.62=174.2 \text{ volts}$$

and the speed by [45] is

$S=30.4\times174.2/5.7=929$ revolutions per minute.

Answer to Question d.

The armature voltage by [3] is

$$E_a=235-5.8\times0.12=234.3 \text{ volts}$$

and the speed by [45] is

$S=30.4\times234.3/5.8=1{,}227$ revolutions per minute.

Answer to Question e.

The armature voltage by [3] is

$$E_a=235-90\times0.12=224.2 \text{ volts}$$

and the speed by [45] is

$S=30.4\times224.2/5.7=1{,}195$ revolutions per minute.

Answer to Question f.

In a four-pole dynamo the number of paths (p') between brushes equals four for a lap-wound armature and two for a wave-wound armature (see solution of Problem 11). Since the constant (K) in equation [45] equals $p'\times6\times10^8/pZ$, for a four-pole machine K for a wave-winding must equal one-half of K for a lap-winding. Hence a change in the type of winding must change K in this case from 30.4 to 15.2.

A change in the type of the winding will also change the armature resistance between brushes. Neglecting the effect of brush resistance, the resistance of each path of the lap-winding is given by [9]

$$0.12=R/4 \text{ and } R=0.48 \text{ ohm.}$$

There are only two paths in the wave-winding and each must have a resistance of 2×0.48, or 9.6 ohms. Again neglecting the effect of brush resistance, the armature resistance between brushes with a wave-winding of the same number and size of conductors is given by [9]

$$R_a=0.96/2=0.48 \text{ ohm.}$$

The armature voltage by [3] is

$$E_a=230-5.8\times0.48=227.2 \text{ volts}$$

and the speed by [45] is

$S=15.2\times227.2/5.8=596$ revolutions per minute.

The reader should not expect to obtain results as precise as those given, as the scale of the curves shown in Fig. 25 does not permit such precision.

An examination of the above results reveals the following facts regarding a shunt motor operated with constant field current:

(1) The speed decreases slightly as the load increases. In this case the speed drops from 1,200 at no load to 1,169 revolutions per minute at full load. In the answer to Question (*a*) it is shown that this is due to the increased resistance voltage in the armature. It is also shown that this effect is compensated for somewhat by the decrease in air-gap flux by armature reaction.

(2) The speed may be reduced by connecting resistance in series with the armature. In this case by adding 0.5 ohm to the armature resistance, the no-load speed was reduced to 1,187 and the

ALTERNATING CURRENTS.

Problem 77.

At the end of a three-phase transmission line there are induction motors which take a total power of 1,860 kilowatts at 0.83 power-factor. The resistance and reactance of the line are 1.21 ohms and 0.98 ohm per conductor. The generators in the power station must be capable of maintaining a constant line voltage of 6,600 volts at the load. An additional load (output) of 1,200 kilowatts must be provided for. Either a large induction motor or a synchronous motor is suitable. An induction motor of this size would operate at a power-factor of 0.91 and have an efficiency of 92 per cent. If a synchronous motor is to be used it should be of such a size as to carry the additional load and also to make it possible to compensate for the lagging current taken by the induction motors so that the resultant power-factor of the entire load may be unity. (*a*) If the induction motor is used, by how much must the current output of the generating station be increased, and what will be the total line loss? (*b*) If the synchronous motor is used what should be its kilovolt-ampere capacity? Assume an efficiency of 90 per cent. (*c*) A synchronous motor of this size has a friction and windage loss of 22 kilowatts, a core loss of 51 kilowatts, and the effective resistance and synchronous reactance are 0.192 ohm and 4.18 ohms per phase. The armature windings are star-connected. If the synchronous motor is used, by how much must the current output of the generating station be increased, and what will be the total line loss? (*d*) To what value must it be possible to raise the excitation voltage of the motor?

full-load speed to 929 revolutions per minute. It should be noted, however, that this method of speed adjustment is unsatisfactory with variable loads since the speed varies widely with the load. The efficiency of the motor is also reduced by reason of the increased heating loss in the armature circuit.

(3) The speed increases with the terminal voltage. In this case by increasing the terminal voltage from 230 to 235 volts the no-load speed was increased from 1,200 to 1,227 revolutions per minute and the full-load speed from 1,169 to 1,195 revolutions per minute. The percentage increase in speed with increase of terminal voltage and constant field resistance depends upon the degree of saturation of the magnetic circuit, as will be shown in the next problem.

(4) Other conditions being the same, a wave-wound armature runs at slower speed than a lap-wound armature, the ratio of speeds being in proportion to the number of pairs of poles. The actual speed of a wave-wound armature with the same number and size of conductors and same armature current is less than this ratio indicates, because of the higher resistance of the wave-wound armature between brushes.

SOLUTION TO PROBLEM 77.

Answer to Question a.

It is often convenient to compute the line current as it is in this case. In a three-phase circuit, whether it be star or delta-connected, the power is

[42a] $P=\sqrt{3}VI\cos\theta$.

P is the total power, V is the line voltage and I is the line current. $\cos\theta$ is the power-factor of the circuit. θ is not the phase angle between V and I but between the phase voltage and phase current.

$$1,860,000=\sqrt{3}\times 6,600 I_1\times 0.83$$
$$I_1=196 \text{ amperes.}$$

The additional output is 1,200 kilowatts and if the motor has an efficiency of 92 per cent the power supplied by the line is $1,200/0.92=1,305$ kilowatts.

By [42a] $1,305,000=\sqrt{3}\times 6,600 I_2\times 0.91$
$I_2=125$ amperes.

Let the phase voltage, that is, the voltage from line to neutral, be taken along the horizontal axis. The horizontal and vertical componets of I_1 are

$$(I_1)_h=196\times 0.83$$
$$=163$$
$$(I_1)_v=-196\sqrt{1-0.83^2}$$
$$=-109.$$

The horizontal and vertical components of I_2 are

$$(I_2)_h=125\times 0.91$$
$$=114$$
$$(I_2)_v=-125\sqrt{1-0.91^2}$$
$$=-52.$$

The horizontal and vertical components of the total line current, I, are

By [26a] $I_h=163+114$
$=277$
$I_v=-109-52$
$=-161.$

By [27a] $I=320$ amperes.

The increase in the current capacity of the generating station is $320-196=124$ amperes.

The total line loss is

$$3\times 320^2\times 1.21$$

or 372 kilowatts.

Answer to Question b.

In this case the power input to the synchronous motor is

$$1,200/0.90=1,330 \text{ kilowatts.}$$

By [42a] $I\cos\theta=1,330,000/\sqrt{3}\times 6,600$
$=116$ amperes.

This is the horizontal component of the current taken by the synchronous motor. If the resultant power-factor is to be unity, the other component of this current must equal 109 amperes so that there will be no vertical component of the total current. The current taken by the synchronous motor is

By [27a] $I=\sqrt{116^2+109^2}$
$=159$ amperes.

The kilovolt-ampere capacity of the motor is

$$\sqrt{3}\times 159\times 6,600=1,820.$$

Answer to Question c.

Having found the approximate size of the motor we can obtain values of its constants from manufacturer's data and thus make a more exact solution of the problem. First compute the horizontal component of the current taken by the synchronous motor. A little ingenuity is required to do this. Let I_2 represent the line current taken by the motor and $(I_2)_h$ and $(I_2)_v$, its horizontal and vertical components with respect to the phase voltage, i. e., the voltage from line to neutral. The resistance loss in the armature is $3\times I_2^2\times 0.192$ or $0.576\times[(I_2)^2_h+(I_2)^2_v]$.

The component $(I_2)_v$ is known. That is, it must equal 109 amperes in order that the total current shall have no vertical component and the resultant power-factor of the entire load be unity.

The input is

$$P_1=1,200+22+51+0.576\times[(I_2)^2_h+109^2]/1,000.$$

Also by [42a] $P_1=\sqrt{3}\times 6,600 I_2\cos\theta=11.44(I_2)_h$ kilowatts. $I_2\cos\theta$ is the horizontal component of the current and thus equals $(I_2)_h$. By combining these two equations we have

$$11.44(I_2)_h=1,273+6.85+0.000576(I_2)^2_h.$$

The approximate value of $(I_2)_h$ is

$$1,280/11.44=112.$$

Correcting this for the term $0.000576(I_2)^2_h$ gives

$$(I_2)_h=112+(0.000576\times 112^2)/11.44$$
$$=112.6.$$

The line current taken by the synchronous motor is

By [27a] $I_2=\sqrt{109^2+112.6^2}$
$=157$ amperes.

This is but little less than the approximate value given in (*b*).

The total current is

By [26a] $I_h=163+112.6$
$=275.6$
$I_v=-109+109=0$

By [27a] $I=275.6$.

Therefore current capacity of the generating station must be increased by 275.6 —196=79.6 amperes. Compare this with the increase in Question (*a*). The effect of using the synchronous motor instead of the induction motor is to reduce cost of the added equipment at the generating station about 35 per cent. This assumes that the cost of equipment is proportional to its capacity, but as this is not true, the actual saving would not be as large. To offset this the synchronous motor, which has a rated capacity of about 1,800 kilovolt-amperes, would probably cost more than an induction motor that would deliver 1,200 kilowatts.

The line loss is

$$3\times275.6^2\times1.21=276 \text{ kilowatts.}$$

This is less than 75 per cent of the loss if the induction motor is used.

Answer to Question d.

The power-factor of the synchronous motor is

By [28a] $P.F.=112.6/157$
$=0.717.$

In order to find the excitation voltage it is best to assume that the current is drawn along the horizontal axis. Since the current is a leading one, the horizontal and vertical components of the terminal voltage are

$$V_h=-3,810\times0.717$$
$$=-2,730$$
$$V_v=3,810\sqrt{1-0.717^2}$$
$$=2,650.$$

The terminal voltage is $6,600/\sqrt{3}$ since the motor is star-connected. The armature current is 157 amperes for the same reason.

By [19a] $E_h=-2,730+157\times0.192$
$=-2,700$
$E_v=2,650+157\times4.18$
$=3,310$

By [20a] $E=4,270$ volts.

The corresponding line voltage is

$$4,270\times\sqrt{3}=7,400 \text{ volts.}$$

It must be possible to increase the excitation voltage of the synchronous motor to this value.

Jovian Rejuvenation in New York City.

A Jovian rejuvenation was held at the Hotel Martinique, New York City, on the evening of March 3. The occasion was quite successful, about forty new members being installed, and some 350 attending. The event was under the excellent management of Frank E. Watts, first tribune; Charles K. Wyatt, second tribune; Louis Hengerer, secretary; James H. Betts, statesman-chairman; and Chauncey Hite, vulcan. President H. H. Scott of the National Electric Light Association and a number of other prominent electrical men were present. A special cabaret entertainment was greatly enjoyed, and a number of interesting Jovian fun elements added to the enjoyment.

DIRECT CURRENTS.

Problem 28.

A 25-horsepower, 230-volt shunt motor takes a current of 8.3 amperes from the line at no load and runs at a speed of 1,200 revolutions per minute when the field current is 2.5 amperes. The air-gap flux for any magnitude of field current is given in Fig. 25 (see page 497); curve A being for an armature current of 5.8 amperes and curve B for an armature current of 90 amperes. The armature resistance (hot) between brushes is 0.12 ohm. The resistance of the field winding (cold) is 65.0 ohms; (hot) 76.6 ohms. An adjustable rheostat is connected in series with the shunt field winding.

With the field winding hot in each case find the armature speed under the following conditions: (*a*) terminal voltage, 230 volts; armature current, 5.8 amperes; field-rheostat resistance, 32.4 ohms (this same resistance (cold) is 27.0 ohms); (*b*) terminal voltage, 230 volts; armature current, 90 amperes; field-rheostat resistance, 32.4 ohms; (*c*) terminal voltage, 230 volts; armature current, 5.8 amperes; resistance of field circuit, 76.6 ohms; (*d*) terminal voltage, 230 volts; armature current, 90 amperes; resistance of field circuit, 76.6 ohms; (*e*) terminal voltage, 230 volts; armature current, 90 amperes; resistance of field circuit, 220 ohms; (*f*) terminal voltage, 235 volts; armature current, 90 amperes; resistance of field circuit, 220 ohms; (*g*) terminal voltage, 235 volts; armature current, 90 amperes; resistance of field circuit, 76.6 ohms.

ALTERNATING CURRENTS.

Problem 78.

A three-phase, 25-cycle, 2,200-volt induction motor is rated to deliver 500 horsepower at full load. The ratio of transformation[1] is 2,200:615. At no load the motor takes 13.5 kilowatts and a line current of 39.8 amperes from a 2,200-volt circuit. With the rotor blocked the power is 117 kilowatts and the line current is 289 amperes when the impressed line voltage is 760 volts. In both of these tests the temperature is 25 degrees centigrade. At this temperature the resistance between terminals is 0.356 ohm for the stator and 0.0285 ohm for the rotor. Assume that the ratio of effective to true resistance at 25 degrees centigrade is the same for the stator as for the rotor, and that the leakage reactances of the two windings are equal when reduced to the same side.

(*a*) What are the no-load power-factor, and the equivalent single-phase no-load current? (*b*) What are the equivalent single-phase true resistances of the stator and rotor windings at 25 degrees centigrade? (*c*) What is the equivalent single-phase true resistance of the rotor at 25 degrees centigrade referred to the stator? (*d*) What is the equivalent single-phase effective resistance of the stator at 75 degrees centigrade? (*e*) What is the equivalent single-phase true resistance of the rotor at 75 degrees centigrade? (*f*) What are the equivalent single-phase leakage reactances of the stator and rotor windings? In the last two questions calculate the rotor constants referred to the stator.

Solutions of the above problems and two new problems will be printed in the next issue.

1 The ratio of transformation is the ratio of the terminal voltage of the stator and rotor at standstill before the latter is short-circuited.

APPRAISEMENT OF SMALL ELECTRIC PROPERTIES.—II.

By Edwin D. Dreyfus.

The first installment of this article took up principally the field work necessary in conducting an appraisal, with a consideration of depreciation. This installment considers office records, unit costs, intangible values, overhead expense, etc. The illustrations shows convenient forms of blanks for records.

Condensed Records.

Well arranged tabulation of the field data is desired. In order to indicate one way of placing this information in convenient form, six sample record sheets are reproduced in Figs. 7, 8, 9, 10, 11 and 12. These forms may not be necessarily of universal application, so that some explanation of the arrangement may prove instructive and lead the way to ready modification so the information may be shaped up to best fulfill the local conditions.

It is preferable to adopt a letter-size sheet 8.5 by 11 inches for convenient filing, but this is manifestly optional. With particular reference to the distribution system and the desirability of keeping the records revised, there are advantages in subdividing the area covered by the system, which would vary according to the size of the property.

In case of the accompanying sheets the most suitable plan was to subdivide first into territories, and then into districts, subdivisions, and finally sections. As different parts of the system are being changed here and there it then becomes necessary only to correct one or possibly a few sheets at any one time.

To avoid carrying the work into such extensive detail as would result from any attempt to assign closely determined percentages to each pole of each different class and size, for instance, which "permutations and combinations" would make the work needlessly burdensome, the condition may be classified as New and Good, Fair, and Poor—this being suggested in view of the preceding discussion regarding accruing liabilities in the shape of "latent depreciation." While very close observation will be noted in the field book as a matter of record, poles and likewise other material may be distributed under these limited classes in the following way, New and Good, 85 to 100 per cent; Fair, 65 to 85 per cent; Poor, 65 per cent and less. These ranges are more or less general but should average out quite satisfactorily. The total appraisal value as used is understood to mean that depreciation has been deducted so that the condition of the property may be compared (for management reasons as previously discussed) with that of replacement value, which is identical with the good-and-new classification under the appraisal items. This point is set forth to exemplify a possible consideration and the great breadth of view to be taken in dealing with this work.

With some of the smaller details, division is made only between *good* and *poor* condition, the first state being that the material still possesses considerable useful life and the latter that early replacement will evidently have to be made.

Sheet 1, Fig. 7, covers poles; sheet 2, Fig. 8, covers cross-arms and line wire; sheet 3, Fig. 9, covers pole-line accessories; sheet 4, Fig. 10, covers transformers and accessories; sheet 5, Fig. 11, covers record for special items; sheet 6, Fig. 12, covers meters. Sheet 3 is chiefly for inventory purposes and not for setting down items of the valuation, as later will be understood in the discussion of unit costs.

Note particularly the provisions for remarks at the bottom of the sheets. This is space for the transfer of such historical data as may be obtained during the field inspection, or as may be secured from other sources, as the company records, or from some informed employee who has been intimately connected with the development of the property.

Figs. 13 and 14 are splendid exhibits of the transition through which small electric properties frequently go. The reconstruction as shown in completed condition in Fig. 14 involves greater expense than when work in new locations is done, and without any interference or removal of old material becoming necessary. Such cases are often an inseparable part of the development of small properties, due to the drawbacks they suffer from during the period of establishing a going business, as accounted for later, and it would be unreasonable that such factors be ruled out in arriving at the present value of the property. Illustrations of this nature are likely to be impressive to those commissioners who have not had direct experience with electric utilities.

Unit Costs.

Among the various probabilities of omitting, in course of appraisal work, real capital expenditures which were incurred in creating the property, there is a grave danger of failing to include all of the legitimate charges incident to performing a given piece of work.

In erecting a power house and installing its equipment, we have a case where the bulk of the work is done at one time and with a single handling of the material, and usually performed independently of an operating organization, so that there should be no difficulty in keeping the records of cost entirely clear and complete. But, when we turn to the distribution system, as a case in point, the pole lines, transformers, meters, etc., are installed in progressive steps as a matter of steady growth and extension after operation begins, so we do not find such a definite dividing line between the money applied for operating, maintenance and construction purposes. In fact we often find that all operating and new construction requirements are taken care of by a single department or management with the same force of men, and this is especially true for small companies.

The results are that either the operating or the construction account suffers unless a very careful distribution of the time and material devoted to the different classes of work is maintained. As

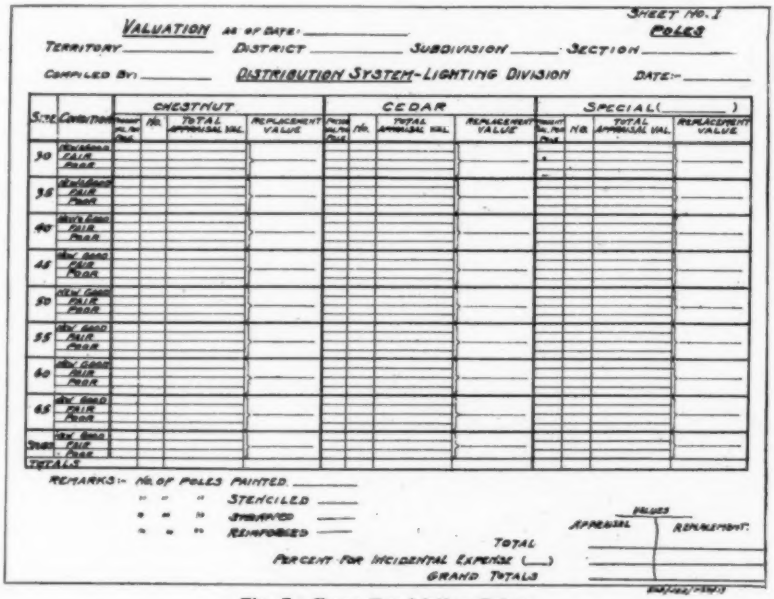


Fig. 7.—Form For Listing Poles.

is well known, any such practice has been exceptional in the past, but in view of the growth of state regulation of utilities, *all public service companies should become more cautious in maintaining their various accounts,* which need is one of the underlying themes of this article.

Any work carried on after a plant commenced to furnish service to a community has almost universally been done by what was considered a regular operating organization, whether it was merely replacing and repairing existing equipment or installing additional lines and material. Consequently, operating expenses bore the brunt of the entire costs, which manifestly reacted upon the ability to pay the full dividends earned upon the capital already invested. This merely represents a deficiency in the previous methods of accounting, which has resulted, of course, in so much of the stockholders' money having been re-invested without due credit having been made.

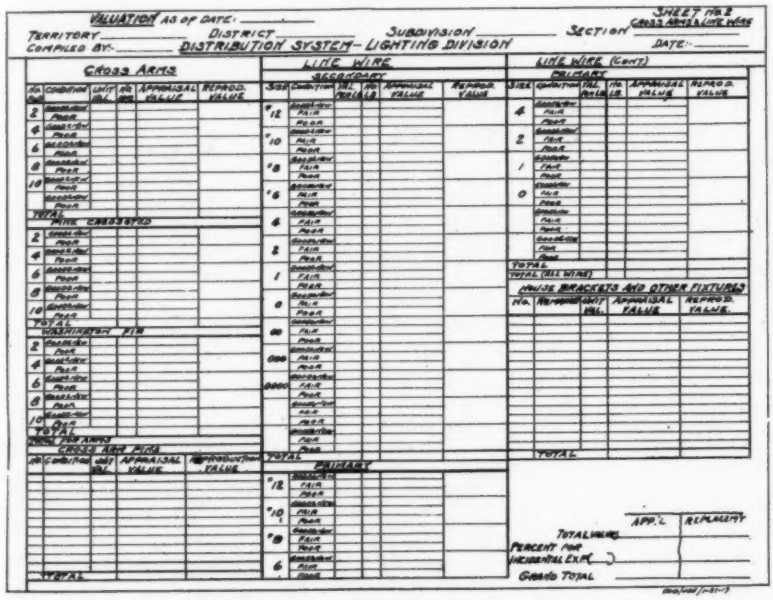


Fig. 8.—Form For Listing Cross-Arms and Wire.

For such reasons, and other inadequate bookkeeping, whatever original costs and book values the companies' records and statements may show generally prove unreliable. Accordingly, to ascertain the true value of a certain property, we must resort to an appraisal as here advocated. Some companies, if not the majority, will defer having their property appraised until necessity compels it. In a recent article referring to mercantile credits, Roger W. Babson, the noted statistical expert on matters of finance, said: "As great stress is laid on a firm's latest inventory, I earnestly urge every local business man to keep his inventory up to date."

Although this view may not apply to the utility company so directly, still it must have some bearing upon its ultimate credit, and along with the other justifications already set down, should provide warrant for undertaking to establish the correct value of its property. It can not fail to affect favorably the company's credit, and due to the increasing competition in the securities market, no doubt the status as disclosed by a valuation will become a greater factor than formerly in the obtaining of new capital.

In order not to be misunderstood, it is well to state that there are presumably sporadic cases where replacements, and possibly other operating expenses, have been charged up to capital account, with the value being accordingly inflated and the property no doubt "milked" for dividends. There can be no countenancing of such practice now or the condoning of its having been done in the past, and it should be a common aim of all utilities that such abuses be rectified so that the majority of the corporations that are now and always have been conservative in their capitalization may be relieved of the stigma heaped upon all of the quasi-public institutions as a class by the radical social reformer and scheming politician. With notably frank and open public policy some of our foremost public-service corporations are "blazing the trail" in reaching out for the full confidence of the public and the investor.

An argument sometimes advanced by different students of the subject of regulation purports that all property constructed from earnings which have exceeded a fair return upon the investment should be excluded from the appraisal value. This contention will receive small support, as it is in effect the condemning of what was formerly considered a desirable conservative practice. No serious attempt has been launched to make regulation retroactive to any such degree as to control or modify the amount of past profits to which the elimination of any such part of the property would be the equivalent, as such profits might have otherwise been distributed in the shape of dividends instead of being applied to improvements and would have therefore passed beyond the reach of any regulatory body. Consequently this consideration may be neglected in fixing the proper capital value of a property.

Other factors of like importance could be enumerated, but it is the object of this limited discussion to principally cite the general features that largely influence valuations. Small properties are particularly liable to suffer for want of sufficient consideration. Most of these had their beginnings under more or less difficulties which required much sacrifice in time and money on the part of their organizers. The placing of the proper value accordingly upon the time devoted to the construction and development of the property (obviously with the expectation of commensurate future reward) might have been profitably turned to more remunerative pursuits had it been anticipated that proper recompense would have been denied them. Any number of such properties have, for instance, been patiently pioneered by local bankers whose ability and discretion in the matter of investments carry no small value. Again the work during the early stages of development or while the property remains in the comparatively small class must be done with what is not the best material and workmanship, so as to strike the necessary balance between expensive talent ordinarily accompanied by efficient work and operation, and the less expensive men with attendant poor economy and inefficient application of work and material. Up to a certain size, a utility company can not retain in its regular employ highly trained men who are able to command comparatively large salaries without disproportionately increasing its operating expenses, so contents itself with the results that may be secured by the payment of modest wages. Naturally the unit cost of different classes of work with the small company will be higher than that with the larger institution which is able to carry on its improvements and construction work under a well organized plan and with experienced gangs. So that to say the unit cost of the small property will exceed that of the larger one 25 per cent or more is not in any sense expanding upon their relative degree.

To determine the real expense of each unit of construction, the various stages and steps taken to provide and install the apparatus in question must be carefully recounted and a rational cost be allotted or assigned to these separate and

distinct elements. As we are so accustomed as a rule to lump the expense, we do not perceive the necessity of such detailed analysis until encountering the difficulty of reconciling estimates with the actual expenditures. General divisions of costs will facilitate thoroughness and may be made as follows:

(*a*) Preliminary expense, as determining upon location of pole, transformer, etc., and obtaining such municipal permit as may be required by ordinance.

(*b*) Manufacturer's or jobber's price of material and supplies f. o. b. point of shipment.

(*c*) Freight.

(*d*) Storeroom expense, which shall include drayage from the depot or sid-

Fig. 9.—Form For Listing Pole-Line Accessories.

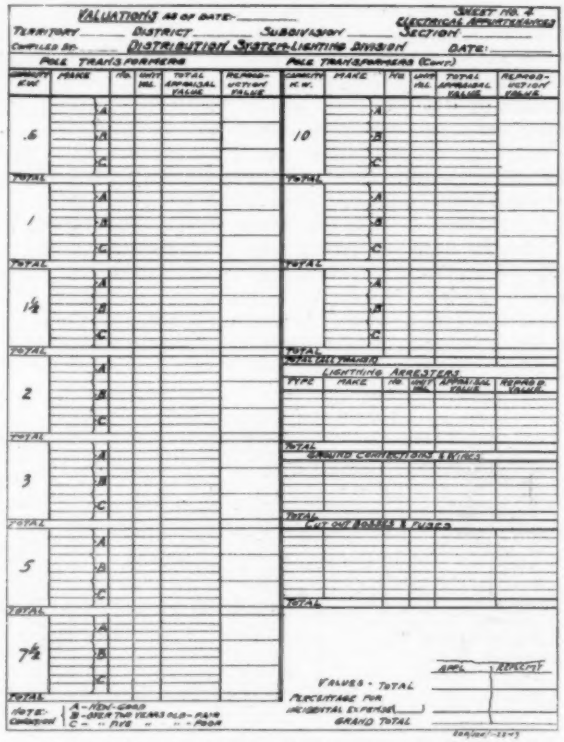


Fig. 10.—Form For Listing Transformers and Accessories.

Fig. 11.—Form For Listing Special Items.

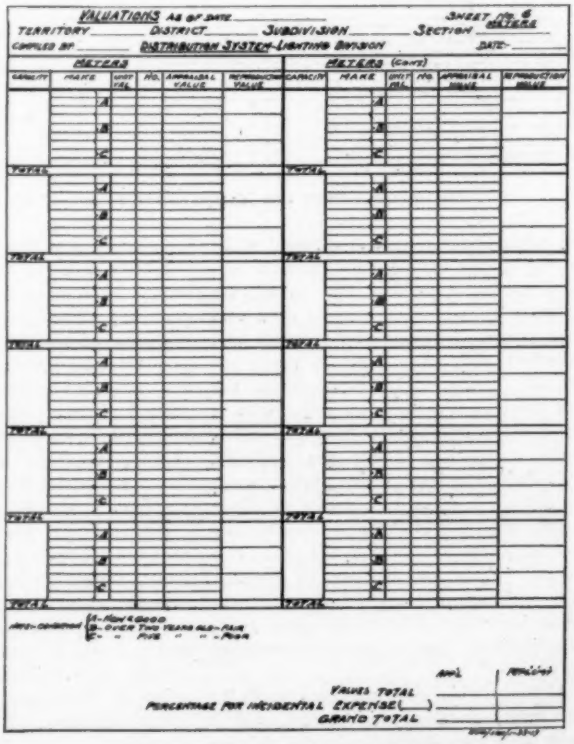


Fig. 12.—Form For Listing Meters.

ing to the storeroom or store yards; storekeeper's salary; due portion of purchasing department expense; overhead charges on stores department, as rent, insurance, breakage, shrinkage, etc., and interest to cover average time the material remains unused in storage.

Where the time of the manager and other employees is divided among various duties, as purchasing, superintending storeroom, inspecting, etc., their time should be suitably distributed among these different accounts as previously noted.

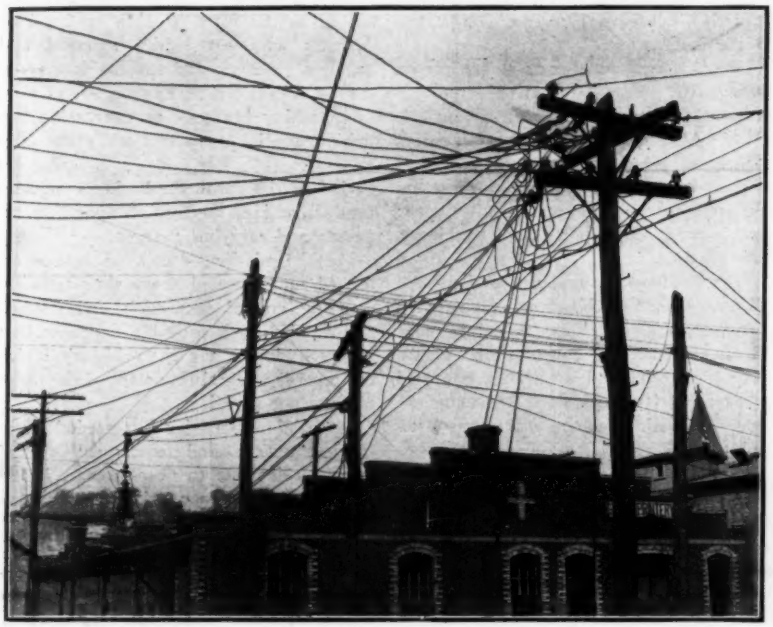


Fig. 13.—Typical Condition Before Reconstruction.

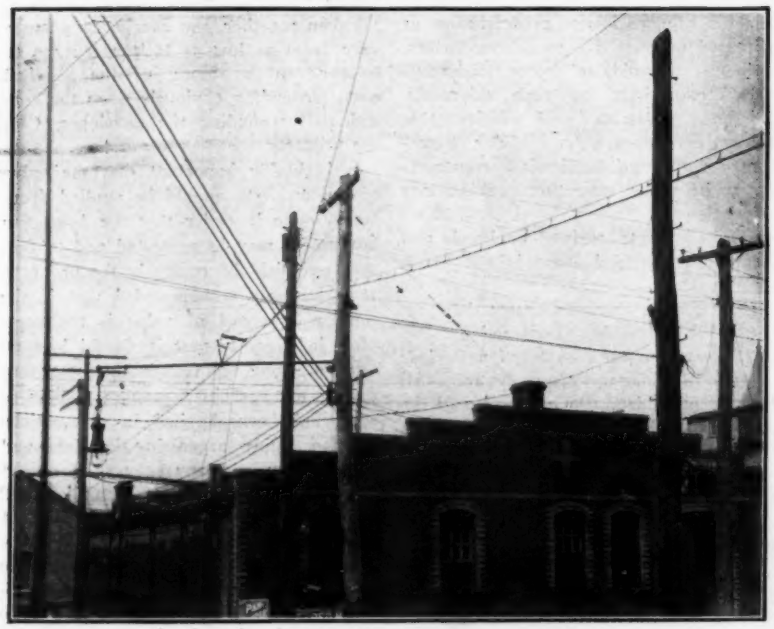


Fig. 14.—Same Poles After Reconstruction.

(*e*) Hauling material from storeroom or yard to the point of installation, including all cost of teams whether hired or owned by the company.

(*f*) All labor to install the apparatus, including foreman.

(*g*) Supervision and inspection. This may require an apportionment of time as already indicated under (*d*).

(*h*) Compute probability of slack time and any lost motion in the travel of men and teams to and from the job without doing effective work, and delays due to failures to deliver material promptly, interference from various causes, changes, etc.

(*i*) Liability insurance: (1) employee; (2) public. This becomes quite an item in some states depending upon the nature of the workmen's compensation laws. If no insurance is carried, a percentage to cover damage suits and settlements incidental to construction work must be determined upon. As insurance rates are based upon vast statistics usually, they should be an acceptable guide in lieu of definite records.

(*j*) All miscellaneous items of expense which may be peculiar to the particular piece of work, location, soil, etc.

While the above is set down as characteristic for the main parts in which we are to conveniently subdivide the distribution system, as poles, cross-arms, insulators, wires, transformers, street lamps and accessories, lightning arresters, anchors, stubs and guys, service connections, meter installations, etc., it serves as an index of cost for all elements of the property. Care must be taken that all matters of cost for these subdivisions of the property are included in composing the unit prices and, for illustration, for poles, the cost of unloading and inspecting, shaving, trimming, gaining, boring, roofing and treating, also the price of steps, digging pole hole (allowing for hard clay, sand stone or rock as encountered) and by any other items that add to the cost of the individual element or unit.

All cost of service connections and initial meter installation shall be similarly dealt with, including meter-board and making proper allowance for such additional expense as entailed in locating the meter or relocating to suit tenant, along with that of the first test of meter, if same has not been included in the storeroom expense.

The cross-arms should have all hardware connected therewith listed, and likewise transformers should have added, the necessary fuses and cutouts (if the same are not a part of the complete price of the transformers), all brackets, platforms, hangers, as may be necessary for their suspension. Special note should be made of all buck-arms, as the installation of same in connection with the stringing of the wire creates added expense.

A complete bill of material should be prepared and job work listed for each unit of cost wherever this may be practically done.

The cost of stringing wire constitutes a most variable expense; it may range from $6.00 to $60.00 per mile of wire, depending upon the conditions and the amount of wire strung at one time. Piecemeal construction such as we have here under discussion necessarily means high cost for wire work and this is again augmented by the frequency which shade trees on the principal street must be avoided and trimmed. Few realize the extent of this expense until costs are

undertaken. It is well to illustrate this by quoting from the report of the Board of Public Utility Commissioners of New Jersey in the Jersey Power Company case:

"From Millbrook to Dover, in our estimate, we have allowed $45 per mile for stringing wire, owing to the conditions under which this wire must be strung." This price furthermore applies to a single wire and not to a circuit or number of wires.

The details of installation cost could be further dilated upon, but those who are familiar with the work are able to readily determine the proper average unit costs.

Where certain work is done by a contractor on a percentage basis, it appears preferable to include same in the physical cost directly because on the other hand the contractor might have undertaken the work for a lump bid and consequently his profits would have been therewith included and formed a part of the physical value.

Prices of equipment and material naturally fluctuate. It is necessary that the appraisal should not be affected by any extraordinary prices as may obtain at the time the valuation is made. The variation in the copper market is a prominent example. There is certain apparatus which, owing to development, commands a high price when first introduced, but in relatively short space of time falls markedly in cost, as the history of the moderate size of steam turbine witnesses. Often market averages for a period of five years or more are employed for this work, but this plainly must not be done indiscriminately as there may be controlling conditions that make such averages inapplicable.

Overhead Expenses and Intangible Value.

In the foregoing such costs as cover the "bare bones" or physical property only have been considered. There are other expenditures of capital necessary—other than the purchase of equipment and material and installing same, along with building required, structures for housing and supports—in order that the creation of the property becomes possible and an earning power be established. These seeming "super-costs" are variously termed overhead expenses, intangible values and non-physical costs, all of which embrace the same accounts. The different valuation reference books—Whitten, Floy, Foster, Hayes, Pond and others—treat of these values at length and give abundant court and commission decisions in support of various theories and opinions. In regard to the overhead and intangibles, mature judgment must be employed together with a careful weighing of the governing developmental and economic factors.

These overheads may be arranged in two principal groups. First, those which are closely associated with construction work and therefore are often called indirect construction cost; and secondly, those which are entirely apart and independent from the actual installation of the physical plant. The latter may again be divided into (*a*) expenses preliminary to construction and (*b*) expenses incident to the development of the business (usually) subsequent to the completion of the installation.

The following represents an outline of these costs.

Indirect Construction Costs:

(1) Administration and Supervision.—Includes salaries of the general office staff and attendant expense of those responsible for the progress of the work; also includes clerk, office rent, stationery, and supplies.

(2) Engineering and Inspection.—All surveys, plans, specifications, reports, inspection, receiving bids, awarding contracts, instructing construction gangs, testing material and apparatus, approval of payment for work done, traveling expenses, board, resident office expenses, and the like.

(3) Incidentals and Contingencies.—It is inevitable that various miscellaneous and unforeseen expenses must be provided for. Under incidentals there appear small items which standing alone are not large enough to be separately listed but in the aggregate range from 2 to 5 per cent of total physical costs. Contingencies are items of cost not readily or sometimes impossible to predetermine, as increased expense due to delays, strikes, accidents, unavoidable errors, underestimates, expressage on rush shipments, overtime, elements and unfavorable weather conditions, extra cost due to temporary work and duplication, constructing while under operation, and various exigencies.

(4) Discounts, allowed on bonds and securities (provided same is not to be amortized).

(5) Interest During Construction.

(6) Taxes During Construction.

Cost Preceding the Construction Period:

(7) Preliminary Investigation.—All costs involved from the conception of the property until a definite organization is established and includes inspection trips, preliminary surveys and reports, conferring with local bodies and representatives and all expenses accompanying the planning of the proposition.

(8) Organization.—The incorporation of company, obtaining of charter, issuance of stock certificates, bonds or other securities, cost of preparing and distributing prospectuses.

(9) Legal Expenses.—Incorporation, charts, franchises (issuance of securities, public service commission approval, contract, agreements, rates, etc.

(10) Promoter's Profit.—Fees and compensation paid the promoter for successfully instituting the enterprise.

(11) Commissions.—To bankers and brokers for underwriting securities, which may be independent of the discounts at which the securities were sold.

Cost Subsequent to the Construction Period:

(12) Working Capital.—Cash, supplies and such quick assets as necessary for proper conduct of the business, and may appear in the form of cash on hand or deposits with the banks, material and supplies, reserves, and surplus funds.

(13) Development Expense.—(*a*) Cost of attaching business, as canvassing, soliciting, special campaigns and other sales expense. (*b*) Early losses, covering the period of time until the business becomes productive, i. e., meeting all operating expenses and carrying charges.

(14) Omission.—Items of cost overlooked or concealed from view notwithstanding critical inspection and investigation, also such probable expenses that occurred during the early history which the records and existing state of the property do not reveal.

(15) Allowances for Superseded Property.—Property and equipment retired from service due to obsolescence, inadequacy and inefficiency, prior to the amortization of the capital represented by such equipment. There are cases where such would be done under prudent management and the value of which would be a deferred charge against capital to be gradually absorbed in the operating expenses.

Taken together, the overhead expenses vary from as low as 10 per cent up to 60 per cent or more, of the physical costs, depending obviously upon the conditions surrounding the development of the property.

It is highly important that the value of the property should be studied from every angle in order that the *bona fide* investment may be protected and to further establish the equity in the property. It is strongly recommended that if the company's record of value is not complete in every respect it should lose no time in laying the foundation for reproducing the cost in a manner similar to what has been detailed in this article. By thoroughly organizing its data and records, the company may then expect to sustain its claims as to capital value.[3] In fact this is just as vital under present regulation as the carrying of fire or casualty insurance, as it makes no difference to the investor whether the loss in capital be due to fire or other damage or to the reduction in valuation due to an inadequate and insufficient appraisal. Most courts and commissions are showing a tendency to display a reasonable and fair attitude on these questions and it simply remains in such instances for the utility

3 See editorial, "Presenting Testimony Before Commissions," ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, Vol. 65, p. 603, September 26, 1914.

to present its case in the most comprehensive and convincing manner.

Commissioner Lane in the Western rate case said: "Perhaps the closest approximations to a fair standard for the basis upon which to compute the return allowed to the public service corporation is that of a *bona fide* investment, the sacrifice made by the owners of the property, considering as part of the investment any shortage of returns there may have been in the early years of the enterprise. By thus taking the life history of a road through a number of years, its promoters are entitled to a reasonable return." But for lack of a complete account and historical information, the actual investment in the property must be approved through the device of a reliable appraisal.

The cost of conducting such appraisal work will vary with the size of the property and the amount of detail undertaken in making the valuation. The work for small properties is evidently proportionately higher than that of the large company. Approximately the range may be given as $5.00 down to 25 cents per $1,000 of value, depending upon the condition of the records, in addition to what has already been stated.

While this article has touched upon the broader phases of the problem it is virtually impossible to exhaust every condition that may be encountered in this important work. For instance, land may require special treatment; again, apportionments may have to be made between different classes of utilities operated jointly; reserve plants and equipment may come up for consideration; special contracts may bear a capital-value equivalent. Extensions may be in progress of construction, and so on. Neither have the phases mentioned been treated fully in any respect, but it is believed for those who have not already made a determined study of the subject the discussion will be instructive. It should emphasize the vital importance of complete information and what is necessary to accomplish, the *desiderata*. In proportion to its importance the case should be cautiously diagnosed and expert opinion secured in order that the healthy condition of the investment should not be placed at risk.

With regulation surrounding the utility, the need for having the actual investment in the property fairly established is substantive as the value of the property is the "hub" about which all of the regulatory machinery must revolve.

The proper attitude for both the public and utility on these important questions was forcefully summarized by Justice Moody in the Knoxville case, from which the following is quoted:

"Our social system rests largely upon the sanction of private property and that state or community which seeks to evade it will soon discover the error in the disaster of its follies. The slight gain to the consumer which he would obtain from a reduction in the rates charged by public service corporation is as nothing compared with the ruin which would be brought about by denying to private property its just reward, thus unsettling values and destroying confidence. *On the other hand, companies to be regulated will find it to their lasting interest to furnish freely the information upon which a just regulation can be based.*"

Annual Report of the Commissioner of Patents.

The annual report of the Commissioner of Patents covering the activities of the United States Patent Office for the calendar year 1914, has been made public. During the year there were received 67,774 applications for patents on inventions, 2,454 applications for patents on designs, 176 applications for reissues of patents. There were issued in 1914, 39,945 patents on inventions, the largest number ever issued in a single year; 1,715 design patents were also issued; 190 patents were reissued. There expired during the year 22,098 patents; 10,022 applications were forfeited for failure to pay final fees within the time prescribed; 19,152 applications were allowed, but held awaiting payment of final fees.

Receipts of the Patent Office in 1914 amounted to $1,993,866.34 for applications; $199,756.21 for copies of patents, drawings, etc.; $32,550.27 for recording of assignments; $7,735 for registration of prints and labels; $25 for court costs; $17,960 for *Official Gazette* and other publications. The total receipts were $2,251,892.82; the total expenditures were $2,000,770.12; the surplus for the year was $251,122.70. This added to previous accumulated surplus earnings of the Patent Office, makes its total surplus on deposit in the Treasury of the United States on December 31, 1914, $7,548,175.16.

Referring in his report to conditions in the Patent Office, Commissioner Thomas Ewing calls attention again to the urgent need for more room and more modern and safer appointments. It is now proposed to erect within the next few years a new building for the Department of the Interior and the General Land Office and when this is completed the building now occupied by these two offices will be turned over to the Patent Office after being remodeled for its needs.

Respecting the personnel, Mr. Ewing recommends reorganization of the examining corps by restoring of the grades of first, second, third and fourth assistant examiners, by equalizing the number of assistant examiners in the various grades, by increase of the number of assistant examiners, law examiners and examiners-in-chief. He shows how these changes will promote the efficiency of the organization, facilitate the work and increase its reliability. During the year consistent effort was made to reduce the number of delayed applications pending, and as a result the number of old cases was very materially decreased. Mr. Ewing believes that with proper administration that it will be possible so to limit the time during which applications are kept in the Office that very few will exceed three years and this without impairing an applicant's right for proper consideration.

In the way of patent legislation Mr. Ewing recommends, among other things: reduction from two years to one year of the right to renew an application forfeited for failure to pay final fees; prohibition of the name of any government official in advertisements of patent attorneys; elimination of payments of fees by treasury certificates of deposit; extension of the time of filing assignments and making the fees therefor correspond to the cost of filing; establishment of an assignees' index; requiring the filing with the Patent Office of every court decree entered in patent litigation.

Power Companies and the Forest Reserve.

Judge John A. Marshall handed down a decision in the United States District Court on February 6 enjoining the Utah Power and Light Company and the Beaver River Power Company from occupying electric power property located on National Forest Reserve. According to Frank J. Gustin, representing the defendant, the case will be appealed direct to the United States Supreme Court. Appeal will be made on the ground that the decision placing the power property under the supervision of the Federal Government is unconstitutional, unreasonable and unjust, and that there is no law in the federal statutes in existence compelling power companies operating on Forest Reserves to submit to the demands of the Government. This case is similar to one decided in the Circuit Court of Appeals against the Utah Power and Light Company two years ago, and similar cases are pending in the federal courts of California and Colorado. The property involved is located in the Cache, Filmore and Wasatch Forest Reserve. The defendants contend that the efforts of the Government to enjoin power companies from occupying forest lands are based on rulings of the secretaries of the Department of Agriculture and the Department of the Interior and not on federal statutes.

National Electric Week Launched.

Thirty prominent salesmen and publicity managers met at the offices of the Society for Electrical Development on March 4 at the request of J. M. Wakeman, general manager. The meeting was held for the purpose of carrying out the decision of the Society's Executive Committee to ask leading commercial men to select a steering committee to handle National Electric Prosperity Week.

Henry L. Doherty acted as temporary chairman and E. W. Lloyd was made chairman.

There was considerable discussion as to the proper time for such a week—whether next fall or the spring of 1916. The consensus of opinion was that while perhaps a year might well be taken to get the maximum efficiency, yet the industry needed a revival now and that the fall would undoubtedly be the best time, considering all conditions. It was decided to leave the matter to analysis by the steering committee, and it is expected that a definite date will soon be fixed.

As to the selection of a steering committee, a nominating committee was chosen as follows: George Williams, Cities Service Company, representing central statons; Ray D. Lillibridge, for the manufacturers; E. W. Rockafellow, Western Electric Company, for the jobbers; J. R. Strong, of the Tucker Electric Construction Company, for the contractors, and Hugh M. Wilson for the trade publications.

This committee met on March 10 to select the steering committee. They will in turn select the 35 men who will represent the central stations, manufacturers, jobbers, contractors, dealers and technical press. One man from each interest will be named as chairman of his division.

The Executive Committee of the National Electric Light Association invited Henry L. Doherty, president, and J. M. Wakeman, general maanger of the Society for Electrical Development to attend its meeting on March 5 at New York City, to discuss the matter of the Association co-operating in the National Electric Prosperity Week campaign.

Following the discussion the Executive Committee voted unanimously to support the movement to the fullest possible extent. The Society is now working with other similarly important electrical organizations to the same end.

The Society for Electrical Development, Incorporated, has greatly extended its publicity work for furnishing through its members or directly to newspapers, magazines and other periodicals, short articles and stories pointing out the utility of electricity in the home, store, factory, etc., and the advantages derived by its liberal use. This work is aimed to increase the popularity of electric service and electrical devices and to correct any misaprehensions there may be regarding cost, etc.

Program of Convention of Iowa State Section.

On April 20, 21 and 22, 1915, the fifteenth annual convention of the Iowa Section, National Electric Light Association will be held in Keokuk, Iowa. The annual convention of the Iowa Street & Interurban Railway Association will be held at this same place on April 22 and 23. The Iowa Electrical Contractors' Association will also hold its annual meeting in Keokuk some time during this period.

Among the papers which will be presented at the convention of the Electrical Association are: Report of Committee on "Possibilities of Business from Rural Transmission Lines;" report of Committee on "Workmen's Compensation Insurance as it Affects Public Utilities;" "Mazda Street Lighting Lamps and Fixtures," by E. M. Walker of the Union Electric Company at Dubuque, and Thomas Crawford of the Clinton Gas & Electric Company, Clinton; "Mazda Lamps," by Henry Schroder, Edison Lamp Works, Harrison, N. J.; "Basic Principles of Rate-Making for Central Stations," by F. A. Warfield, rate engineer, Illinois Traction System, Peoria, Ill.; "Controlled Flat Rates in Connection with the Excess Indicator," by E. T. Hughs, new-business manager, Union Electric Company, Dubuque; "Power Development Methods for Iowa Central Stations," by Edward Soukup, new-business manager, Iowa Railway & Light Company, Cedar Rapids; "Maximum Demand Meters," by J. V. Montgomery, Mississippi River Power Company, Keokuk; "Oil Engines for Small Light & Power Stations," by a representative of the Busch-Diesel Oil Engine Company, St. Louis, Mo.; "Revised Report of the Facts and Factors Committee, Financial Side of Electric Power Transmission," by Prof. Arthur H. Ford of the State University of Iowa, Iowa City; "Safety First" lecture with illustrated slides and moving picture films.

The members of the Association will be the guests of the Keokuk Electric Company, and the Mississippi River Power Company, Stone and Webster properties, and they have spared no expense in arranging for suitable entertainment for the members and their wives, the latter also being invited to attend the convention. The entertainment will include a banquet given by the manufacturers and their representatives, followed by an illustrated lecture on the "Development of the Keokuk Water Power," automobile trip along Lake Shore Drive for the women, after which they will stop at the Keokuk Country Club for refreshments and some sort of entertainment, a smoker to be held at the Elks' Club, followed by the rejuvenation of the Jovian Order, theater parties, etc. It is intended to charter one of the large Mississippi River steamboats on the last afternoon for the purpose of a ride up the Mississippi River, holding session on the boat in the afternoon, having dinner on the boat, in the evening having a dance, returning to Keokuk about 11 p. m. Guides will leave the Iowa hotel at certain periods of the day for the purpose of taking parties through the celebrated power house of the Mississippi River Power Company, and special cars have been arranged to take those who might be interested, across the river to Warsaw, Ill.

It is not intended to hold a regular electrical show, but space has been provided for any salesmen of manufacturers who might wish to display their appliances during the convention.

It is anticipated by the officers of the Electrical Association that at least 500 people will be registered in Keokuk during this time.

Chicago Electric Club Meeting.

Prof, Morgan Brooks, of the University of Illinois, delivered an interesting address before the Electric Club of Chicago, March 4, on "Some Illumination Fallacies." He referred to several of the fundamental terms commonly used in the science of illuminating engineering which are often misleading to the layman. In this category are "candlepower," "intensity," etc. Certain commonly accepted laws are also often confusing, such as the inverse square law. Prof. Brooks spoke of the many variables in the science and urged that the human element be given more consideration. Often an installation which is scientifically correct does not result in good lighting, or is objectional from an esthetic standpoint.

Prof. Brooks urged that greater attention be given the matter of interior decorations, as this affects the efficiency of a lighting system. In conclusion he referred to the care of the eyes and the effect of poor lighting. He advised against continual reading without changing the position of the page so as to vary the intensity of the light.

Ninth Annual New York Electrical Show to be Held Next October.

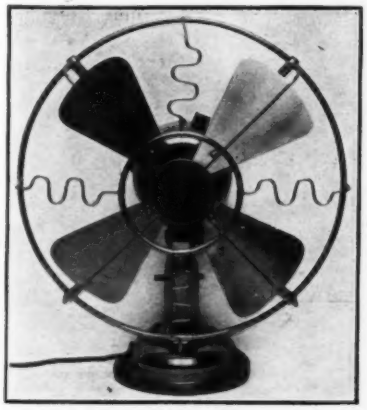
For the ninth consecutive year the New York Electrical Show will be repeated next fall. Plans are already under way. The dates are October 6 to 16 and the place, as usual, will be the Grand Central Palace, New York City. Arthur Williams is president of the exposition company.

New Electrical and Mechanical Appliances

New Crocker-Wheeler Fan Motor.

The Crocker-Wheeler Company, Ampere, N. J., has placed on the market this year an additional type of nine-inch alternating-current fan which embodies some novel features. In place of the usual rheostat lever for securing different fixed speeds, the speed is varied by rotating the core containing the windings inside of the fan housing. Not only can fine adjustment of speed be secured, but the current consumption varies with the speed, so that while the power consumed at full load is about 24 watts, the power consumed at low speed is approximately 7 watts.

The fan is started and stopped by means of a push switch located in the base. It can be started and stopped at any speed at which it is fixed to run. The fan guard is very substantially



New Nine-Inch Alternating-Current Fan.

made, as well as the fan itself, thus eliminating danger of accident due to mechanical weakness in connection with these two points.

Fan users will readily recognize the advantage of being able to place a fan at one corner of a desk and secure sufficient breeze for relief from hot weather, and at the same time not have all the papers blown off.

New Trumbull Sign Receptacles.

Two new types of sign receptacles for sheet-metal electric signs are being placed on the market by the Trumbull Electric Manufacturing Company, Plainville, Conn. Of these, Fig. 1 shows a two-screw receptacle that is similar in design to the screw receptacles now commonly available on the market, but it is of exceptionally sturdy construction.

Fig. 2 shows an original design known as the clamp receptacle that has several unique features. With this receptacle no screw holes are necessary in the sign, which alone saves the wireman a great deal of time in mounting this type. These receptacles are in-

Fig. 1.—New Screw-Type Sign Receptacle.

stalled from the rear of the sign; the clamp is attached to the sign and the screws tightened, which completes the work without reaching to the front of the sign at all. Screw-type receptacles, on the contrary, require a man in the rear to hold the base of the receptacle, while another man in front screws the top into the base. The receptacle can be turned in any direction to line up with the wires before tightening the screws; this cannot be done with other types. When the screws are tightened, which is quickly done, it is impossible to turn the receptacle in the sign, in fact, it is claimed that the sheet iron will bend or tear before receptacle becomes loose. These clamp receptacles

Fig. 2.—New Clamp-Type Sign Receptacle.

can be used for any thickness of sheet iron.

A Handy Fountain-Pen Light.

A new type of pocket flashlight, exactly like a "banker's" fountain pen in size and appearance, has been placed on the market by the American Ever Ready Works, 308 Hudson Street, New York City.

This fountain-pen light has several important and original features. The light can be either flashed or burned continuously, as desired, and laid down while burning, so that both hands are free to work. The dry cell for this light has been designed and made with special care and only the highest grade of materials are used in it. Its life, as shown by tests, is said to be longer than any of other similar-sized batteries on the market and is fully guaranteed.

The entire outfit is 5.75 inches long, 0.75 inch in diameter, and weighs only

Pocket Light in Form of Fountain Pen.

1.5 ounces. It has a clip so that it can be securely carried in the vest pocket, without inconvenience. The price, complete with battery, is $1.00. It makes a very handy device for illuminating theater programs, house numbers, names on letter boxes, key holes, etc.

Ostrander Electromechanical Gongs for Equitable Building.

W. R. Ostrander & Company, of 22 Dey Street, New York City, were the successful bidders for the largest single order of electromechanical gongs ever

Electromechanical Alarm Gong.

installed in an office building in this country. These bells, 82 in number, were installed two on each floor of the new Equitable Building in New York City, claimed to be the largest office structure in the world. Considerable satisfaction was manifest by the manufacturer, because the order was placed through the biggest fire-alarm company in New York, and was awarded on a basis of quality and price.

Powerful Electromagnet for Removing Iron Splinters Imbedded in Eye or Skin.

The removal of pieces of shrapnel, steel-jacketed bullets, etc., by the use of powerful electromagnets in hospitals abroad has been acclaimed by many newspapers as the very latest application of science to surgery. It is interesting to note that the Westinghouse Electric & Manufacturing Company has installed in the Relief Department of its East Pittsburgh Works a magnet for removing metal embedded in the flesh, which is one of the most powerful in the world.

The magnet is mounted on a box containing the resistor, which is used to regulate the amount of current flowing through the coils. It requires a number of different shapes being supplied for various classes of work.

It is very common for flying bits of metal to lodge in the eye. Should they strike with force enough to become embedded, the removal, without the aid of a powerful magnet, is apt to be difficult as well as painful. The protecting coating of the eye must be cut, and there is danger that instead of removing the particle it may be pushed further into the eye. When the foreign body is once within the eyeball it is properly a case for the specialist.

Steel workers frequently have their hands punctured with minute pieces of metal, which become embedded under the calloused skin. If these bits are allowed to remain, the wound is likely to become infected. The use of a powerful magnet insures the removal of all traces of iron from wounds in the hand, or any other part of the body. Some remarkably small pieces have been extracted in this way, one recently recovered being not a twelfth of the thickness of a delicate needle.

Dr. C. A. Lauffer, medical director of the Westinghouse Electric & Manufacturing Company, relates a number of incidents in which the magnet has proved invaluable. Among these is the rather amusing case of a workman who attempted to drill one of his own teeth. The drill broke off about half an inch from the end and remained in the cavity, and it seemed as if the only way to remove the drill would be to pull the tooth. However, a special extension was made and fitted to the magnet pole. As soon as the extension was brought in contact with the drill and the current switched on the drill was immediately drawn out.

Powerful Electromagnet Removing Iron Particles From the Eye.

Electromagnet Removing Iron Splinters From Hand.

4,000 watts for its operation. It is designed for operation on 70 volts, and as the circuit from which it draws current is used for testing purposes in the works and ranges from 70 to 120 volts, a resistor is necessary.

It is not an infrequent occurrence for steel and iron workers to get bits of metal in their eyes or hands. Previous to the installation of a magnet the only means of removal was by probing, a method which is as uncertain as it is painful. Since this machine was put in operation it is a very simple proceeding to extract such particles. The portion of the body in which the foreign particle is embedded is placed near the pole tip of the magnet, the switch closed, and the magnet does the rest. The pole is removable,

Acetylene Head Lamp for Troublemen.

A convenient type of acetylene lamp worn on the head like a miner's lamp is being manufactured and placed on the market by R. C. Kruschke, of Duluth, Minn. It was designed for use primarily by hunters, trappers, fishermen and others who make camping trips to the northern woods and lakes. A great many of these lamps are used by the troublemen of the Northern Power Company, of Duluth, and other light and power companies, for locating trouble at night and in completing rush work after dark. These users are said to be highly pleased with the outfit.

The complete outfit, which is known by the trade name Brilliant Searchlight, consists of an automatic acetylene generator carried on the belt or in the pocket, and the lamp and reflector, which are of very light weight, are the only parts carried on the forehead. They are attached by means of an adjustable soft strap and are worn without discomfort. The reflector is of aluminum or sterling silver and is shaped to throw all the light forward. A single or double lens serves further to concentrate the light into a powerful beam of great penetrating power. The reflector is adjustable, so that the light may be turned up or down. Several types of burner can be used and the flame itself can be adjusted

as to height by means of a screw feed. A self-lighting burner can also be furnished. A flexible non-collapsible rubber tube connects the lamp and generator. The latter is of simple construction and automatically regulates itself to furnish whatever quantity of gas is needed. The generator is easily cleaned. Its usual charge is four ounces of carbide which permits the lamp to burn eight hours with a one-eighth-foot burner.

The outfit can be supplied with a fiber or leather carrying case in which the generator and head strap with lamp and tube connected, also a two-pound can of carbide, can be conveniently placed while not in use, but so as to be instantly ready for service. Slight modifications in the outfit are made for special purposes.

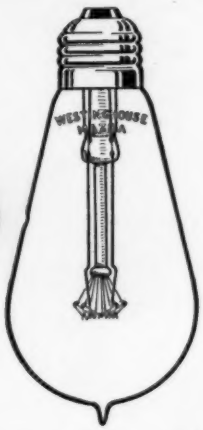
Acetylene Head Lamp and Generator Outfit.

Large New Addition to Robbins & Myers Plant.

A large four-story and basement reinforced concrete building was recently completed for the Robbins & Myers Company, Springfield, O. This structure is entirely of modern fireproof design and construction, and makes an important and much needed addition to the company's manufacturing plant. The building is 363 feet long by 82 feet wide at its narrow end.

The departments that have moved into the building are as follows: Basement, punch-press department, bar-stock storage, heating plant; first floor, shipping department, screw-machine department, turning department, shaft-turning department; second floor, plating, polishing and finishing sections, fan-machinery department and stock room; third floor, fan assembly and detail machine departments, stock rooms; fourth floor, experimental laboratory, stock rooms, lecture room.

There is installed throughout the building a sprinkler system and a dust-collecting system. Heating is by hot water. Facilities for the comfort of employees are liberaly provided. The building was designed by W. E. Russ, architect, Indianapolis, Ind., and erected by the Structural Concrete Company, Dayton, O.



Concentrated-Filament Lamp.

New Concentrated-Filament Construction in Small Mazda Lamps.

The Westinghouse Lamp Company has just standardized 25, 40 and 60-watt Westinghouse Mazda lamps with a concentrated-coil-filament construction similar to that used in the large gas-filled type C Mazda lamps. The small lamps, however, are not gas-filled but of the usual vacuum type.

The new filament construction greatly increases the downward or useful light of the lamps, which makes them particularly desirable for service where natural distribution in the downward direction is required.

These new lamps are supplied in the usual bulbs, the 25 and 40-watt sizes in the S-19 bulb and the 60-watt lamp in the S-21 bulb for 105 to 125 volts. Their rated life is 600 hours.

Ground Antenna in Place of Aerial.

The Wireless Society of Tufts College, Medford, Mass., has been experimenting with ground antenna in place of aerial wires. Important results have been gained, particularly from the standpoint of the uses of the wireless telegraph in military work.

Instead of the 120-foot pole carrying the wires, the latter were laid upon the ground in a direct line with the receiving station, this direction giving the most efficiency in receiving messages.

Proof of this fact was obtained by laying a series of wires along the ground in various directions, and testing the intensity of signals received. It was found that the intensity was less as the direction of the wires diverged from a straight line with the transmitting station. If the wires were at a 67.5 degree angle with the station, it was impossible to obtain any sound with the receiving apparatus. Two wires 90 feet long, laid along the ground were found to be sufficient to receive messages from stations as far distant as Portsmouth, N. H., and Newport, R. I., 60 and 75 miles.

By means of the ground antenna it was possible to locate the direction of a sending station within five degrees. This was accomplished by laying out a complete circle of wires, connecting them in separate pairs by means of a rotary switch, and noting which wires had the greatest intensity.

Reinforced-Concrete Addition to Robbins & Myers Generator, Motor and Fan Factory.

A New High-Voltage High-Capacity Cutout.

With the ever increasing capacity of distributing circuits, and the concentration of large amounts of power within very restricted areas, the capacity of distributing transformers has grown until the problem of protecting these large transformers has become a very live and increasingly difficult one.

The Chemelectric Company, 4327 Kenmore Avenue, Chicago, Ill., manufactures a fuse block known as the S & H high-voltage, high-capacity cutout, which supplies the need for adequate protection of transformer and circuit alike, and gives central-station managers a cutout possessing the strength, ruggedness and characteristics of a circuit-breaker at but a fraction of the price.

Fig. 1.—High-Voltage Primary Cutout.

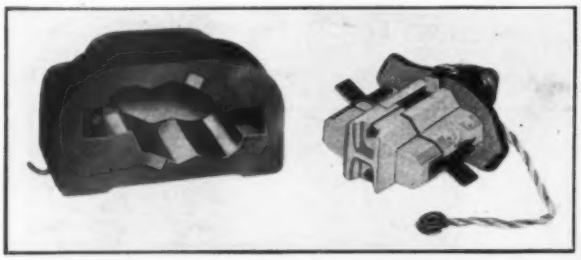


Fig. 2.—High-Voltage Cutout With Plug Detached.

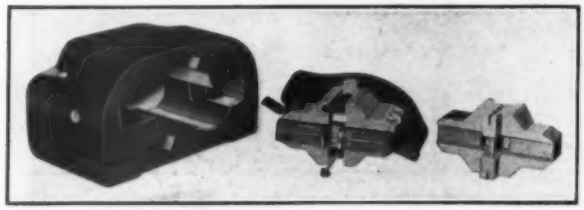


Fig. 3.—Plug Separated to Show Fuse Link.

As there is practically no gas formation, due to the rapid quenching of the arc and the entire absence of air pockets within the cutout, the explosive effect, which has come to be looked upon as almost characteristic of all fuse blocks, is entirely absent. Nor is there any tendency for the removable plug to blow out, even on the most severe short-circuits. The action of the fuse is uniform, positive and reliable, and the manufacturer states that this cutout can be relied upon to interrupt successfully the short-circuit current of the largest distributing transformers yet built.

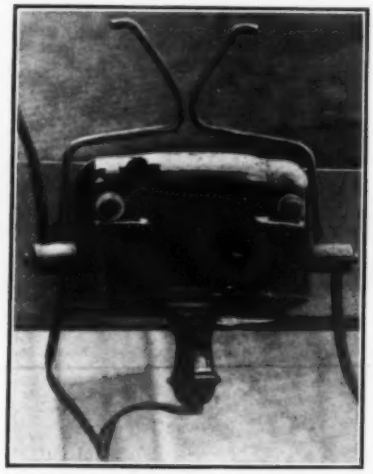


Fig. 4.—Cutout Installed With Horn Gap.

The massive proportions and solidity of the cutout are such that it is not affected by weathering, and warping and cracking will not occur even under the most extreme temperature changes. The strong handle and ample shield enable these cutouts to be handled with safety whatever the climatic conditions, and the plug may be inserted on short-circuit without apprehension for the safety of the workmen. The movable element is fastened to the main body of the block by a cord furnished for the purpose; by this means the chance of accident is practically eliminated due to the plug falling, while the cost of renewing the plug is saved.

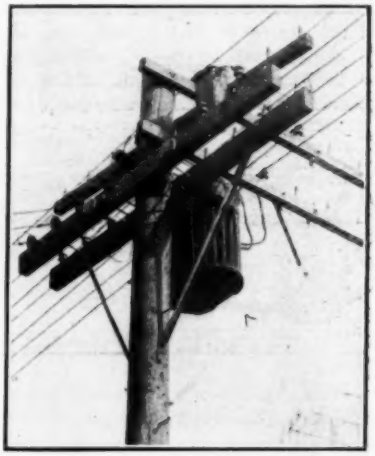


Fig. 6.—Transformer With Cutout.

Another unique and ingenious feature of the S & H cutout is shown in Fig. 4, and consists of a horn gap shunting the cutout. This horn gap acts as a bypass for any lightning that may come in on the line, and thus saves the cutout from being shattered, as usually occurs. This little device has proved invaluable in a number of cases, and is strongly recommended by the manufacturer for use where lightning is of frequent occurrence, and particularly in those cases where it

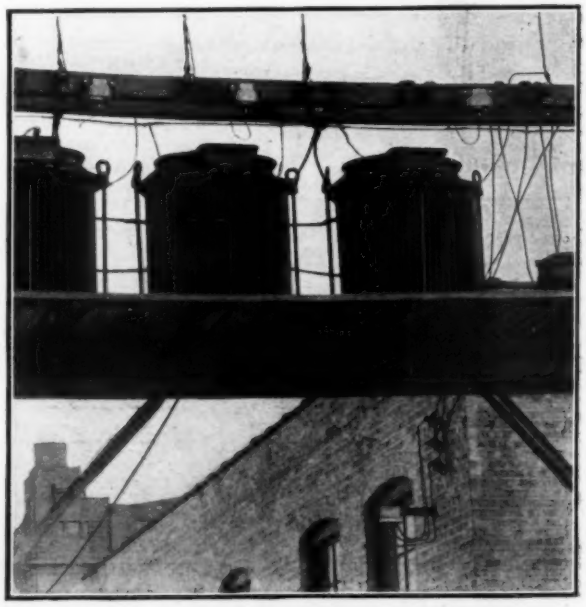


Fig. 5.—Three Transformers Protected by New Cutout.

The S & H high-voltage, high-capacity cutout is made of glazed porcelain of most liberal proportions, as is shown in Fig. 1. The fuse link is carried between two blocks of a special stone under pressure (Figs. 2 and 3); when the fuse blows the molten metal is immediately flattened out to a non-conducting form and chilled.

is the practice to ground transformer cases.

This type of S & H cutout is made in two sizes, namely, for 150 and 250 amperes at 2,400 volts. The compact and unobtrusive appearance of this cutout is well shown in Figs. 5, 6 and 7, which incidentally show some interesting details of line construction.

The Chemelectric Company is also responsible for the introduction of the well known S & H oil-immersed cutout. This latter cutout is of similar design, and operates on the same principle as the cutouts described above, except that the cutout is submerged in oil and the whole block incased in a sheet-steel covering. The S & H oil-immersed cutout is for use in localities where the atmosphere is highly charged with impurities. It has been found impossible to prevent porcelain from absorbing volatile matter and

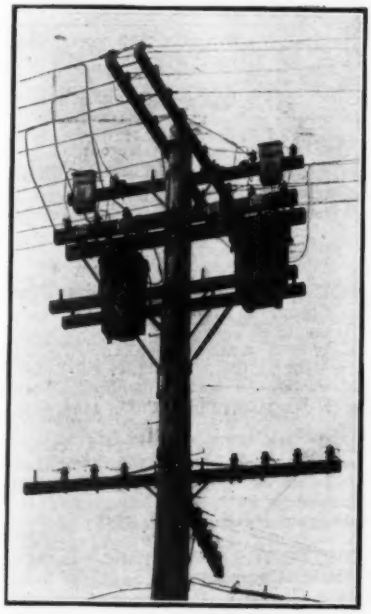


Fig. 7.—Another Transformer and High-Voltage Cutout Installation.

from holding the condensation in certain atmospheres, and it is in such localities that this cutout finds a great demand.

This cutout has been installed in localities where the atmosphere is highly charged with impurities of a most virulent nature, and endless service interruptions were experienced due to corrosion of the fusing element by atmospheric influence until the S & H oil-immersed cutout replaced other types, since which time no trouble whatever has been experienced from the deleterious effect of chemical influences.

The S & H cutout has been in service now for a considerable length of time and has, it is claimed, unfailingly proved itself capable of protecting the largest distributing transformers on the most high-capacity circuits yet in use.

Electrics in Boston Auto Show.

The Boston Automobile Show, which opened March 6 and continued through the week, combines the passenger car and commercial divisions usually held on separate weeks. Interest in this year's show is well up to that in former years, while the combination of passenger and business cars in one show gives it a double interest.

Electric cars and trucks, while not shown in so great numbers as formerly, are attracting much attention, particularly the commercial end, economy in transportation, as in other lines, being the watchword this year.

The halls of Mechanics' Building, in which the show is held, are resplendent with myriad colored electric lamps arrayed in clusters and festoons. Two orchestras dispense music, and various other attractions are presented.

Exhibits of electric cars and accessories are as folows:

Anderson Electric Car Company, Detroit, shows three models, two four-passenger broughams, and a model 50 cabriolet. Thin-plate Philadelphia batteries, assembled at the Anderson factory, are installed.

J. W. Bowman Company, Boston, exhibits a four-passenger brougham of the well known Waverley type.

Rauch & Lang Carriage Company, Boston, shows a model B-5 four-passenger brougham, worm drive, with wire wheels.

E. Y. Stimpson, Boston, agent for the Milburn electric, has on exhibition a four-passenger coupe, a two-passenger roadster and a light delivery wagon, all equipped with Philadelphia batteries. The Milburn car is seen for the first time in Boston. Its lightness and low cost are talking features. It weighs about a ton less than other cars and sells at around $1,200. For two years the Milburn Wagon Company, of Toledo, has been experimenting on a car which can be produced at low cost and yet combines beauty, speed and comfort. The body is of the full streamline type and is hung low on four cantilever springs. The wheelbase is 100 inches, giving space for a roomy body.

Andover Motor Vehicle Company, Andover, Mass., shows a one-ton contractors' wagon equipped with Edison battery. Features are the height of battery, which is divided into four parts, of 12 cells each, suspended two feet from the ground, on steel frame hinged to the chassis. By removing the casing on either side of the vehicle, each battery section can be swung out and the cells made accessible in a minute's time. The company claims 60 to 70 miles a day on a single charge, with a speed of 12 to 14 miles per hour. A novel idea is the entrance of the driver's cab by a door in the front, this giving economy of space and enabling the weight of load to rest evenly on the wheels.

General Vehicle Company, Day Baker, New England manager, shows a 1,000-pound truck chassis, noteworthy for high speed through its worm drive. A safety feature is, when the brake is applied the power is automatically shut off. When the switch is thrown to the neutral point the brake is locked and the car cannot be tampered with when left standing. A second chassis is exhibited for a two-ton chain-drive truck.

American Storage Battery Company, Cambridge, Mass., exhibits specimen cells, a self-starting battery for automobiles, and an isolated lighting plant.

Motor Parts Company, Boston agent for the Bosch Magneto Company, is showing a Bosch starting and lighting system, and also those of the Rushmore and Kemco types. A lag machine is on exhibition to demonstrate the electrical lag to a battery current.

General Electric Company, Lynn, Mass., exhibits its new Ford starting-lighting system, the features being power transmission through a single chain and inherent regulation, there being no external moving parts except reverse-current cutout.

Gray & Davis, Incorporated, Cambridge, Mass., is showing its well known starting-lighting systems for gas cars.

Disco Electric Starter Company, through Walter J. Forbes, New England agent, exhibits its self-starting and lighting system, a feature being the additional support provided for motor and generator.

Stewart-Skinner Company, Worcester, Mass., is showing its lightning-bug electric lanterns.

Automobile Appliance Company, Boston, is exhibiting the Boston Ford starter.

Small Mazda Lamps With Concentrated Filaments.

The distinctive features of the concentrated-filament Mazda lamps of high wattages have proved so popular that the Edison Lamp Works of General Electric Company has developed vacuum Mazda lamps of similar appearance in the 25, 40 and 60-watt sizes. This concentrated-filament construction gives greater vertical distribution of light than produced by the regular Mazda lamps of corresponding wattages. The new lamps will, therefore, be employed where natural distribution of light downward is required. They can be used in existing sockets and fixtures.

These lamps will be made in the same size bulbs as the corresponding regular Mazda lamps, will have the same spherical watts per candlepower efficiency and will have a rated average life of 600 hours.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

CABINETS. — Superior Electric Manufacturing Company, 2416 University Avenue, S. E., Minneapolis, Minn.

Cabinets shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Approved Feburary 1, 1915.

HEATERS, Electric.—Vulcan Electric Heating Company, 1100 Military Road, Buffalo, N. Y.

Electric flat irons, 104-220 volts, 500 watts, six-pound size.

With detachable plug, catalog Nos. 9100, 9102, 9105.

With permanent connection and heel rest, catalog Nos. 9110, 9112, 9115.

With permanent connection, no heel rest, catalog Nos. 9120, 9122, 9125.

All of above are supplied with vulcan sheet-metal stands and with standard plugs and cord.

Records show that electric flat irons when left with current turned on are frequent causes of fire. In irons listed above no adequate means have been provided for eliminating this recognized hazard. In other electrical and mechanical details, these irons and accompanying stands are judged to be suitably constructed.

Approved February 5, 1915.

INSULATING MATERIALS.—F. C. H. Kurzrock, Columbus, O.

A treated sandstone for use as a substitute for slate in electrical appliances.

Approved January 29, 1915.

LAMP ADJUSTER.—Lamb Brothers and Greene, Nappanee, Ind.

"L. B. & G." Adjuster for open wiring and pendent lamps, consisting of a standard key socket, a length of portable cord, a spring-controlled composition drum, to which ends of portable cord are attached and connected in circuit through insulated brushes and contact rings. A cylindrical brass shell incloses operating parts and is provided with an insulating bushing at lower end through which cord passes.

Approved February 5, 1915.

PANELBOARDS.—Large-Dail Manufacturing Company, 114 North Thirteenth Street, Philadelphia, Pa.

Panelboards shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, have labels attached.

Approved January 25, 1915.

PICTURE MACHINES AND APPLIANCES.—Kinak Motion Picture Company, Incorporated, 1777 Broad- New York, N. Y.

"Kinak" motion-picture machine, a portable, automatic, motor-driven, motion-picture machine, complete with metal housing and paper screen, for principle of reflection and using an opaque positive paper film.

The electrical parts of device comprise eight 8-volt incandescent lamps in series on a special circular fixture with a current limiting resistance, a 0.02-horsepower motor with an automatic reversing switch, and necessary wiring connections. Rating, 5 amperes, 110 volts.

Standard for use only with photographic paper films supplied by this manufacturer.

This appliance presents only such hazards as are necessarily involved in installation and use of an automatic motor-driven electric appliance of small capacity.

Note.—As rating of ordinary key or pull sockets is 250 watts, 250 volts, and as this rating is not intended to be interpreted to permit use at any voltage of current above 2.5 amperes, device described above should not be used on ordinary lighting circuit.

Approved February 5, 1915.

RECEPTACLES, For Attachment Plugs.—Hart and Hegeman Manufacturing Company, 342 Capitol Avenue, Hartford, Conn.

"H. & H." Flush receptacles and plugs, 10 amperes, 250 volts.

Catalog Nos. 2034, 2850, 2870.

Approved January 29, 1915.

RECEPTACLES, Standard.—Weber Electric Company, Schenectady, N. Y.

Brass shell.

Key, 250 watts, 250 volts, catalog Nos. 1199, 1202, 1204, 1222, 1224, 1438, 1528, 1549.

Keyless, 660 watts, 250 volts, catalog Nos. 1203, 1205, 1223, 1225, 1299, 1439, 1529, 1568.

Pull, 250 watts, 250 volts, catalog Nos. 1201, 1207, 1209, 1231, 1233, 1235, 1243, 1245, 1440, 1548, 1569.

Porcelain shell.

Keyless, 1500 watts, 600 volts, catalog No. 1423.

Also above types with shadeholders attached.

Key types with composition or insulated metal key.

Approved January 9, 1915.

SIGNS, Electric.—Eugene I. Rosenfeld and Company, 10 South Howard Street, Baltimore, Md.

Electric signs shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, have labels attached.

Approved January 28, 1915.

SOCKETS, Standard. — Harvey Hubbell, Incorporated, Bridgeport, Conn.

"Hubbell" brass-shell sockets.

Key, 250 watts, 250 volts, catalog No. 3648.

Keyless, 1,500 watts, 250 volts, electrolier, for fixture use only. Catalog Nos. 3383, 3384.

Also above types with shadeholders attached.

Approved February 5, 1915.

SOCKETS, Standard.—Peru Electric Company, Peru, Ind.

Porcelain key socket. Catalog No. 4002.

Approved February 2, 1915.

SOCKETS, Standard.—Weber Electric Company, Schenectady, N. Y.

Brass shell.

Key, 250 watts, 250 volts, catalog Nos. 1102, 1105, 1108, 1129, 1400, 1493,

Keyless, 660 watts, 250 volts, catalog Nos. 1103, 1106, 1109, 1148, 1401, 1494.

Pull, 250 watts, 250 volts, catalog Nos. 1104, 1107, 1128, 1149, 1492, 1495.

Also above types with shadeholders attached.

Approved January 29, 1915.

SWITCHES, Automatic.—Paragon Electric Company, 9 South Clinton Street, Chicago, Ill.

Paragon time switch.

This device consists of a clock and spring-actuated motor, operating a standard double-pole surface snap switch. All parts are mounted in a cast-iron case.

10-30 amperes, 250 volts. Types 1, 2, 3, 4.

Approved January 12, 1915.

SWITCHES, Combination Cutout. —The Trumbull Electric Manufacturing Company, Plainville, Conn.

Porcelain-base switches, with Edison plug cutouts, 30 amperes, 125 volts, catalog No. 728.

Approved January 30, 1915.

SWITCHES, Rotary Flush.—The Bryant Electric Company, Bridgeport, Conn.

"Bryant" or "Perkins."

Single-pole, 5 amperes, 75 volts, catalog Nos. 40-48 inclusive, 1 to 8-gang, with sheet-steel supporting frames; for use only in steel walls of Pullman cars which contain no combustible materials.

Approved January 18, 1915.

Current Electrical News

ATLANTIC STATES.

KEENE, N. H.—The Keene Gas and Electric Company, R. D. Smith, superintendent, is constructing a 66,000-volt line from Keene to Dublin, N. H., about 15 miles distant; a line for 2,300 volts is being constructed at Harrisville, N. H.

PORTSMOUTH, N. H.—The Rockingham County Light and Power Company, F. A. Belden, superintendent, is rebuilding five miles of transmission line.

BROCKTON, MASS.—The Edison Electric Illuminating Company, A. F. Nelson, manager, expects to build a modern transformer house in the northern part of the city, and install an additional pair of feeders from Brockton to North Easton.

NORTH ATTLEBORO, MASS.—The town will vote on March 15 on the question of extending the street and commercial lighting districts.

ELMIRA, N. Y.—The Elmira Water, Light and Railway Company, F. H. Hill, general manager, will build several miles of additional 6,600-volt power circuits, will wire the entire town of Wellsburg; renew trolley wire; rebuild secondaries, and undertake some considerable new construction.

LESTERSHIRE, N. Y.—It is understood that the board of trustees will extend the boulevard lighting system during the present year.

WATERTOWN, N. Y.—Upon the recommendation of its special committee, appointed to investigate the question of a municipal lighting plant, the board of directors of the Chamber of Commerce have gone on record against the establishment of such a plant at this time. The resolution expresses the opinion of the board to the effect that a municipal plant would be "too costly and impractical in comparison to the service and cost the city is at present deriving from the private company."

PHILLIPSBURG, N. J.—The city commissioners are considering the installation of about seventy-seven boulevard lighting standards on South Main Street from Union Square to Jefferson Street. The estimated cost of the entire work was given as $7,500. Frank Kneedler is mayor.

ALLENTOWN, PA.—The congregation of St. James Reformed Church, has awarded the contract for their new $50,000 edifice here to the Ochs Construction Company, of Allentown. The electrical installation, which will be thoroughly modern in every respect, will be made under a separate contract to be given out later.

NORRISTOWN, PA.—The Counties Gas and Electric Company, H. H. Gauser, manager, will install a 2,500-kilowatt turbo-generator; condenser, pumps and auxiliary apparatus; 500-horsepower boiler, new brick stack, necessary piping, etc. The company is building 15 miles of 13,000-volt transmission line, and will supplement this with a corresponding increase in its 2,300-volt distribution system.

READING, PA.—A local syndicate, headed by John Witman, has made a proposal to the city council to build a new electric plant, furnish street lighting at a low rate, and at the expiration of a term contract turn the plant over to the city at a cost of not more than $25,000.

WEST PITTSBURGH, PA.—Sealed proposals for the lighting of the streets and roads of the township of Chartiers, Allegheny County, with 250 street lights, more or less, to be located under the direction of the Board of Township Commissioners, will be received until March 16 at the Schaeffer School Building, West Pittsburgh Station. Address D. S. Ramsay, president.

MARTINSBURG, W. VA.—Officials of the Martinsburg Power Company announce that a contract has been entered into with representatives of Philadelphia capitalists to finance the power company by organizing a new company with a capital of $1,000,000. The Philadelphia people have assumed charge of the power offices and plant here, and the two waterpower plants along the Potomac at Dam Number Four, and Dam Number Five. The plans for reorganization include the payment of all obligations of the power company and the exchange of stocks and bonds for securities in the new company.

CLIFTON FORGE, VA.—The Virginia-Western Power Company, A. C. Ford, secretary-treasurer, will extend its transmission lines from Balcony Falls to Clifton Forge, approximately 40 miles, at 44,000 volts.

CHARLOTTE, N. C.—The Southern Power Company, C. I. Burkholder, general manager, will build 48 miles of 100,000-volt line, actual work having started.

WILMINGTON, N. C.—The Chamber of Commerce has voted against the proposition of municipal ownership of the electric light and gas plants in this city.

UNION, S. C.—The city will erect a 6,600-volt, three-phase transmission line. Address R. A. Easterling, superintendent Electric Light and Water Works, in charge of construction.

NORTH CENTRAL STATES.

ATHENS, O.—The Athens Electric Company is making a special effort to interest domestic consumers by offering special rates for the installation of wiring and fixtures, in order to enlarge its load, since current became available from the Hocking Power Company's Floodwood plant. L.

CINCINNATI, O.—The Union Gas and Electric Company, W. W. Freeman, president, has almost completed plans for its new power plant, and work will be started in a few months.

TOLEDO, O.—The Toledo, Bowling Green & Southern Traction Company recently announced its intention to spend $116,000 in the city of Findlay, O., upon its property in that city. The lighting plant will be reconstructed at an expense of $30,000. Approximately $38,000 will be spent on rails and ties and other changes on the city lines. A new plan of lighting has been decided upon which will call for 36 arc lights between the Lake Erie railroad ad Lima Street. H.

YOUNGSTOWN, O.—A considerable amount of electrical equipment will be required in the construction of the new $30,000 building of the Youngstown Telephone Company. Architect C. H. Owsley has the plans. L.

YOUNGSTOWN, O.—A repair shop with electrical equipment, wiring, lighting and so forth will be among the features of the large garage to be built by Pfau & Faunce. It will cost $50,000.

WARREN, O.—The American Glass Specialty Company will manufacture a line of incandescent electric lights and similar goods. The company was recently incorporated with a capital stock of $10,000, by J. E. Quackenbush, H. E. Quackenbush, and others.

MIDDLETOWN, ILL.—The village council has ordered the village attorney to draw an ordinance calling for a special election to vote $4,000 bonds for a municipal lighting system. The plan is to contract with the lines of the New Holland Electric Company of New Holland, Ill.

LAPEER, MICH.—The taxpayers of Lapeer will have a chance at the spring election to pass judgment on two very important and closely related questions,—a boulevard system of lighting for Lapeer, and a municipal lighting plant.

SAGINAW, MICH.—The proposed $500,000 bond issue for a municipal lighting plant has been defeated. The lighting company now proposes to put into operation a reduced rate for lighting and power service.

GREEN BAY, WIS.—The Wisconsin Public Service Company contemplates the extension of a 15,000 or 26,000-volt three-phase transmission line from Wrightstown to Kaukauna; extension of a 2,300-volt, three-phase power line and single-phase lines for local distribution in Greenleaf.

KENOSHA, WIS.—The appointed committee will report favorably on the immediate installation of the proposed decorative lights in the downtown district of the city, but before the council can let a contract for this it will be necessary to pass an ordinance and advertise for bids. Address Chairman Swift, of the Lighting Committee.

CHISHOLM, MINN.—The Chis-

holm Electric Company, R. M. Heskett, manager, will erect a new power station and overhaul its lines.

CHISHOLM, MINN.—The Chisholm Electric Company has decided to construct a $50,000 building to accommodate contemplated extensions and is only waiting for favorable weather conditions in order to begin the work. The new building has been designed by Grant Ford, the company's architectural engineer. The company is also contemplating the installation of larger wires in order to be able to properly handle the increasing demand for electricity.

FAIRMOUNT, MINN.—Plans for the electric wiring of the local poorhouse have been completed and a copy placed on file with the Builders' Exchange, Minneapolis.

HIBBING, MINN.—Improvements that will cost from $100,000 to $157,000 have been recommended for the Hibbing, Minn., municipal electric lighting plant by R. E. McDonnell and W. A. Harding of Burns & McDonnell, consulting engineers, Kansas City, who were employed by the Hibbing water and light board to make a thorough investigation of the valuation of the plant and the cost of producing electricity.

MAPLE LAKE, MINN.—The Light and Power Company of St. Cloud has been awarded the right to build and operate a light and power plant in this village by a recent order of the council.

BELFIELD, N. D.—The Beach Electric Company, now supplying power to Beach, N. D., has made application for a franchise to the village council of Belfield permitting the company to operate an electric light plant in that town.

WATERTOWN, S. D.—The Watertown Light and Power Company, C. H. Bell, superintendent, expect to build about 25 miles of secondary construction and a few blocks of primary construction.

WOONSOCKET, S. D.—The Schuler Electric Company of this place, of which A. G. Schuler is president and manager, has completed remodeling its plant. It now proposes to extend its transmission lines and supply power and current to six neighboring villages.

OMAHA, NEB.—The Saunders municipal light bill has passed the Senate and the measure will be reported to the House immediately.

CEDAR RAPIDS, IOWA.—The Iowa Railway and Light Company will add two new boilers, smoke stack, ash conveyor, stockers, etc., to its powerhouse. The company may also extend a high-tension line from Perry to Grand Junction, and thence to Jefferson.

SOUTH CENTRAL STATES.

LEWISBURG, KY.—Work has begun on the new building for the electric lighting plant which will be operated in connection with the Lewisburg planing mill, recently purchased by V. L. Price.

SMITHS GROVE, KY.—Smiths Grove Light and Power Company will install a $5,000 electric light plant. Gill Edwards, of Pembroke, Ky., manager.

BARTLESVILLE, OKLA.—The Bartlesville Railway Company will enlarge and improve its power plant at a cost of $5,000, will erect addition to present brick building, and install condenser costing $3,500.

BRISTOW, OKLA.—A franchise has been granted to the Bristow Electric Company, and the $20,000 bond issue voted two years ago for the construction of a municipal light plant has been cancelled.

CUMBY, TEX.—The Cumby Electric Light Company will rebuild its power and light plant, which was recently destroyed by fire. D.

MALAKOFF, TEX.—S. J. Hall has installed an electric light and power plant here. D.

ORANGE, TEX.—The Orange Ice, Light and Water Company will purchase a 150-kilowatt generator and other equipment for its electric light plant. D.

ROXTON, TEX.—The Texas Power and Light Company will construct an electric lighting system here. D.

WESTERN STATES.

PUEBLO, COLO.—The Arkansas Valley Railway, Light and Power Company will rebuild about 40 miles of transmission line between Pueblo and Skaguay. New business and prospective business will require considerable equipment.

ANACONDA, MONT.—The Seills & Ironside Mining and Milling Company is electrifying its property, which is located on the south fork of Boulder Creek, about 15 miles northeast of Butte in Jefferson County. A complete outfit of motors, generators, transformers and other necessary electrical equipment has arrived and is being installed on the property. The power will be furnished by the Montana Power Company, whose main transmission line crosses near the property.

DEER LODGE, MONT.—A resolution has been adopted by the City Council creating Improvement District 32, and has announced its intentions of installing a cluster lighting system in this district, which covers Main Street, at a cost of about $6,000. Reported active construction will begin shortly.

IDAHO FALLS, IDAHO.—N. M. Holm, of Shelley, and F. C. Bowman have been granted a certificate of public convenience by the public utilities commission granting them the right to operate a power plant at Ashton and to build power lines from the plant to the Mud Lake country and to Roberts. The power lines will be used to pump water through about 20,000 acres of land which it is proposed to develop. The construction work on the power plant is about two-thirds completed.

PAYETTE, IDAHO.—The Idaho Light and Power Company, according to W. A. Ross, representative, will shortly begin construction of an electric transmission line through the Payette Valley. This concern holds electric light and power franchises in New Plymouth, Payette, Fruitland and Emmett, and the lines will serve these villages and farmers along the line. The company owns two large power plants, one at Swan Falls and the other at Malad. It is understood the Payette Valley line to be built will be connected with both plants, thereby assuring continuous service. O.

SHERIDAN, WYO.—The lighting district bill, drawn up at the instigation of the Sheridan Commercial Club, has been introduced in the State Legislature. The bill was drawn largely by members of the legislative committee of the club, working with the legislators from here, and was introduced in the house by Representative Kendall. The bill provides for the creation of special lighting districts in cities whenever a majority of the property owners of a certain district declare themselves willing to stand the expense of installation of the special lighting fixtures. With the fixtures in, it devolves upon the city as a whole to undertake the expense of lighting and maintaining the system. The bill as drawn applies only to business sections of cities. This measure, if passed, will, it is believed, overcome the obstacles which have stood in the way of ornamental street lighting in Sheridan, an improvement which has been before the public for several years.

WILCOX, ARIZ.—A committee is securing funds for the installation of telephone service between Aravaipa and Benita.

LOS ANGELES, CAL.—The Pacific Electric Railway Company has applied to the State Railroad Commission for authority to sell its electric distributing system in Venice, Los Angeles county, to the Southern California Edison company.

ROBIE, CAL.—The Standard Consolidated Mining Company has been authorized by the State Railroad Commission to transfer a hydroelectric system in Mono county to J. S. Cain for the sum of $25,000 cash and the cancellation of a claim of $700,000 which Mr. Cain alleges that he holds against the mining company.

VENTURA, CAL.—County Surveyo Petit has prepared plans for an ornamental lighting system for this city at the request of the Chamber of Commerce. The matter is to be acted upon shortly.

PROPOSALS.

ELECTRIC FREIGHT ELEVATOR.—Sealed proposals will be received by the Supervising Architect, Treasury Department, Washington, D. C., until March 30, for the installation complete of an electric freight elevator in the extension of the United States postoffice and courthouse at Detroit, Mich., in accordance with the drawing and specification, copies of which may be had at the office of O. Wenderoth, Supervising Architect, Washington, D. C.

ELECTRICAL EQUIPMENT.—Sealed proposals will be received at the office of the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 23, for furnishing 140 buzzers, for radio work; miscellaneous interior-communication cable; 500 feet telephone cable; 5,500 arc-lamp carbons; 160 legless type keys; 4 parabolic searchlight mirrors; 250,000 feet bell wire; 15,000 feet braided antenna wire; 185,000 feet double-conductor wire; 8,500 feet twin-conductor wire, all under Schedule 8005, for delivery at Navy Yard, Brooklyn, N. Y. Also 25 electrolyic cells, Schedule 7996, for delivery at Navy Yard, Brooklyn, N. Y.; one 15-kilowatt turbo-generating set, Schedule 7997, for delivery at Navy Yard, Boston, Mass.; 15,000 feet single rubber-covered wire, Sched-

ule 8004, for delivery at Navy Yard, Brooklyn, N. Y.

NEW PUBLICATIONS.

CABLE TERMINOLOGY.—The Bureau of Standards, Washington, D. C., has issued a second edition, illustrated, of Circular No. 37, entitled "Electric Wire and Cable Terminology."

ELECTROMETER.—Scientific Paper No. 239 of the Bureau of Standards is entitled "A Vibration Electrometer," by Harvey L. Curtis. A description of the instrument is given, with theory and experiments.

ELECTROTYPING.—Circular No 52 of the Bureau of Standards is entitled "Regulation of Electrotyping Solutions." It is a preliminary statement of the work which has been taken up by the Bureau regarding the composition and operation of electrotyping baths.

MAGNETIC PERMEABILITY.—Scientific Paper No. 245 of the Bureau of Standards is entitled "Temperature Coefficient of Magnetic Permeability Within the Working Range," by Raymond L. Sanford. It is shown that the temperature coefficient differs greatly not only in different specimens but also in the same specimen after different heat treatments.

NEW INCORPORATIONS.

MALVERN, ARK.—The Citizens Light Company has been organized with a capital of $20,000 by R. S. Brooks and others. Will apply for franchise.

McRAE, GA.—The McRae-Helena Telephone Company has been incorporated with a capital of $20,000 by J. F. Cook and others, to construct a telephone system.

NEW YORK, N. Y.—Deuth & Company, Incorporated. To do contracting and electrical work of all kinds. Capital $50,000. Incorporators: Eugene J. Deuth, Victor Steinfeld and Bessie Herman.

BEASON, ILL.—The Beason Telephone Company has been incorporated with a capital of $6,500 by Geo. A. Curry and others, for maintaining and operating a telephone exchange.

NACOGDOCHES, TEX.—The Procella Telephone Company has been organized here for the purpose of installing and operating a local telephone system. The incorporators are G. A. Blount, E. H. Blount and Frank Sharp, Jr. D.

NEW SEWICKLEY, PA.—The New Sewickley Light Company has been granted a state charter to operate in New Sewickley township, Beaver county. Capital $5,000. Incorporators: A. W. Stevenson, A. W. Robertson, J. R. McNary, L. F. Kane and E. W. Washbaugh, Pittsburgh, Pa.

FINANCIAL NOTES.

The Virginian Power Company has sold to A. B. Leach & Company $3,800,000 first and collateral five-per-cent bonds, which will be offered at 90 with 30 per cent of the common stock of the company.

A special meeting of stockholders of the American Telegraph & Telephone Company will be held March 29 in New York to decrease the number of directors. The annual meeting will be held the following day.

The Electric Bond and Share Company offers $1,000,000 of new preferred stock to the preferred stockholders at par, in the ratio of one new share for each five shares of old stock owned. The common stockholders are offered $1,000,000 new common at par, in the ratio of one new share for each five shares of the old stock owned. Stockholders of record March 3 have the right to subscribe.

The Consolidated Gas, Electric Light and Power Company, of Baltimore, has called a special meeting for March 22 to act on a resolution to increase the capital stock from $20,000,000 to $30,000,000. The company must provide $2,500,000 new stock for the conversion of the $2,500,000 notes recently sold, and it was deemed advisable to provide at the same time for the corporate needs of the company for a long time to come. There is no intention of issuing any of the new stock in the immediate future.

The Alabama Power Company, the operating subsidiary of Alabama Traction, Light and Power Company, has sold $2,000,000 six-per-cent three-year first-mortgage bonds to Harris, Forbes & Company. The new bonds are part of an authorized issue of $5,000,000 and are a first lien on all properties of the company, subject only to $278,800 Anniston Gas and Electric Company first fives and $49,000 Huntsville Railway and Light first sixes.

A syndicate of bankers will soon offer for subscription the $10,921,000 of first-mortgage five-per-cent Commonwealth Edison bonds just authorized by the Illinois Public Service Commission. Proceeds of the new issue of bonds will go to retire the $7,000,000 one-year notes, due the coming summer, and proposed improvements to the generating and distributing systems will require about $3,806,000 additional. Of Commonwealth Edison's new $10,921,000 first-mortgage bond issue, $7,115,000 will reimburse the treasury for improvements during the past five years. The management says the pending sale of bonds conforms with the company's policy of extending its business, and this year's budget is about normal.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Mch. 8	Mch. 1
American Tel. & Tel. (New York)	120½	118¾
Commonwealth Edison (Chicago)	138	138¾
Edison Electric Illuminating (Boston)	240	238
Electric Storage Battery common (Philadelphia)	48⅝	48
Electric Storage Battery preferred (Philadelphia)	48⅝	48
General Electric (New York)	139	139
Kings County Electric (New York)	119	119
Massachusetts Electric common (Boston)	7	7½
Massachusetts Electric preferred (Boston)	46	44
National Carbon common (Chicago)	135	127
National Carbon preferred (Chicago)	—	119
New England Telephone (Boston)	—	—
Philadelphia Electric (Philadelphia)	24	23⅞
Postal Telegraph and Cables common (New York)	74½	73
Postal Telegraph and Cables preferred (New York)	65	65¼
Western Union (New York)	63¼	62
Westinghouse common (New York)	68½	65
Westinghouse preferred (New York)	117	117

Dividends.

	Term.	Rate.	Payable.
Ark. V. R. L. & P. pf.	Q	1.75%	March 15
Braz. T. L. & P. cum. pf.	Q	1.5%	April 1
Broc. & Plymouth St. Ry. pf.	S-A	$3.00	March 15
Can. Gen. Elec.	S-A	3.5%	April 1
Can. Gen. Elec., pf.	Q	1.75%	April 1
Can. Westinghouse	Q	1%	April 10
Cln. & Sub. Telep.	Q	2.5%	April 1
Cleveland Ry.	Q	1.5%	April 1
Col. Ry. P. & L. Ser-A., pf.	Q	1.5%	April 1
Duluth-Sup. Trac. com.	Q	1%	July 1
Duluth-Sup. Trac. pf.	Q	1%	April 1
East. Pr. & Lt. Corp. pf.	Q	1.5%	March 15
Interb. Rap. Tran.	Q	2.5%	April 1
Manhattan Ry.	Q	1.75%	April 1
Muskogee G. & E. pf.	Q	1.75%	March 15
N. Y. State Rys.	Q	1%	April 1
N. Y. State Rys. pf.	Q	1.25%	April 1
Southern Util. pf.	Q	1.75%	April 1
*Stand. G. & E. pf.	Q	1%	March 15
Twin City Rap. Tran.	Q	1.5%	April 1
Twin City Rap. Tran. pf.	Q	1.75%	April 1
United Lt. & Rys. 1st pf.	Q	1.5%	April 1
United Lt. & Rys. 2d pf.	Q	0.75%	April 1
United Trac. & Elec.	Q	1.25%	April 1
West End St. Ry.	Q	3.5%	April 1
Western Elec.	Q	2%	March 31

*Payable in scrip.

Reports of Earnings.

NORTHERN OHIO TRACTION AND LIGHT.

	1915	1914
January gross	$280,839	$270,951
Net after taxes	98,860	99,669
Surplus after charges	48,609	50,207
Balance after preferred dividends	33,102	35,635

UTAH POWER & LIGHT COMPANY.

The Utah Power & Light Company reports earnings for the year ended January 31, 1915, as follows:

	1915	1914
Gross	$2,178,316	$1,837,108
Net earnings	1,117,692	1,085,835

MISSISSIPPI RIVER POWER.

	1915	1914
January gross	$137,083	$128,488
Net after taxes	109,463	105,043
Surplus after charges	1,082	29,030
Twelve months' gross	1,585,064	
Net after taxes	1,258,942	
Surplus after charges	183,630	

PERSONAL MENTION.

DR. WILLIAM McCLELLAN, of New York City, a manager of the American Institute of Electrical Engineers, received the honorary degree of Electrical Engineer from the University of Pennsylvania in February.

MR. C. H. BLUMENAUER, president of the Jefferson Glass Company, Follansbee, W. Va., visited Chicago this week enroute to California where he will visit the expositions at San Francisco and San Diego.

MR. JAMES H. McGRAW, president of the McGraw Publishing Company, Incorporated, delivered a lecture entitled "Reasons for Trade and Technical Publication" in the Forum on Industrial Journalism at the New York University, Wednesday evening, March 10.

MR. CLIFFORD E. PARKHURST has become associated with the Enterprise Electric Fixture Company, A. L. Oppenheimer, president, Cleveland, O., as manager designer. He has had a wide experience in the designing of lighting fixtures and will find many opportunities in this enterprising organization for the exercise of his ability.

MR. W. B. CRABTREE, for many years connected with the selling organization of the Fort Wayne Electric Works, has established an office as commercial engineer at 810 Majestic

Building, Milwaukee, Wis. Mr. Crabtree is specializing in the sale of motors and motor accessories, and is also acting as electrrical engineer for the Wisconsin River Power Company, especially in connection with the Prairie du Sac development. He is well known in electrical circles, is a prominent and active worker in the Jovian ranks, and a familiar figure at many state and national gatherings of electrical men.

MR. JAMES T. DANIELS, of Columbus, O., has been made traffic superindent of the Ohio Division of the Central Union Telephone Company, with headquarters at Columbus, according to announcement made by General Manager E. A. Reed. He succeeds the late F. W. Whitten, who died in a Columbus hospital in January, following an operation. The new traffic superintendent has been with the Central Union since 1900. He was manager of the Columbus exchange when promoted in January, 1912, to the position of special agent in charge of collection and accounting methods in Ohio, which he continued to hold until called to his present important responsibilities.

OBITUARY.

MR. THOMAS J. COPE, a prominent inventor of many electrical devices, died recently in Philadelphia at the age of 73 years. He is survived by his widow and one daughter.

MR. HERBERT A. DAVIDSON, chief engineer of the Edison Electric Illuminating Company of Brockton, Mass., died at Saranac Lake, N. Y., March 4, aged 42 years. Mr. Davidson was born in Brockton and had always lived there. He entered the employ of the lighting company in 1891 and was chief engineer for the past ten or twelve years. A wife and three children survive.

DATES AHEAD.

Railway Signal Association. Annual convention, Auditorium Hotel, Chicago, Ill., March 15-18. Secretary, C. C. Rosenberg, Times Building, Bethlehem, Pa.

Westinghouse Agent-Jobbers Association. Hotel La Salle, Chicago, March 15-16. Assistant Secretary, H. P. Pritchard, East Pittsburgh, Pa.

Electrical Supply Jobbers' Association. Spring meeting, Hotel La Salle, Chicago, Ill., March 17-19. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

American Institute of Electrical Engineers. Industrial Power meetings, Cleveland, O., March 18-19; Pittsburgh, Pa., April 15-16. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York, N. Y.

Minnesota Electric Association. Annual meeting, St. Paul, Minn., March 23-25. Secretary, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

National Association of Electrical Inspectors. Annual convention, Hotel Martinique, New York City, March 23-25. Secretary, W. L. Smith, Concord, Mass.

Electrical Committee, National Fire Protection Association. Annual meeting, 123 William Street, New York City, March 24-25. Secretary, Ralph Sweetland, 141 Milk Street, Boston, Mass.

Mississippi Electric Association. Annual meeting, Hattiesburg, Miss., April 12-14. Secretary, H. F. Wheeler, Hattiesburg, Miss.

Georgia Electrical Contractors' Association. Annual meeting, Atlanta, Ga., April 15. Secretary, T. H. McKinney, Atlanta, Ga.

Iowa Section, National Electric Light Association. Annual convention, Keokuk, Iowa, April 20-22. Secretary, W. H. Thompson, Jr., Des Moines, Iowa.

American Electrochemical Society. Annual meeting, Hotel Chalfonte, Atlantic City, N. J., April 22-24. Secretary, J. W. Richards, South Bethlehem, Pa.

National Electric Light Association. Annual convention, San Francisco, Cal., June 7-11. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

With the Electrical Manufacturers

The Beers Sales Company announces the removal of its offices from Bridgeport, Conn., to No. 1 Hudson Street, New York, N. Y. The company is the exclusive general sales agent for the Lyhne lamp and the Beers lantern.

Crouse-Hinds Company, Syracuse, N. Y., has issued bulletin No. 1A on types O and P panelboards with push-button switches in branch circuits. This is a supplement to panel and cabinet bulletin No. 1. A large variety of these new boards are listed.

Sprague Electric Works of General Electric Company, New York City, has recently opened a branch sales office in Cleveland, Ohio. It will be in charge of Frank H. Hill, manager, who also has charge of the Pittsburgh office. The Cleveland office will be located in the Illuminating Building.

The A. O. Schoonmaker Company, 88 Park Place, New York City, has issued a new standard price list of its India and amber electrical mica. This can be furnished uncut or cut to size. Mica rings, washers, tubes and plates are also listed, as well as insulating cloths, tapes and papers.

Doubleday-Hill Electric Company, 719 Liberty Avenue, Pittsburgh, Pa., has prepared a circular describing its new vacuum impregnating process and equipment for thoroughly insulating electric coils with a durable, heatproof and flexible compound. The advantages of the process are pointed out.

The Evolution Phone Company, Incorporated, 3 East Fourteenth Street, New York City, has issued some circulars showing the value of its Therapphone hand receiver earcap in improving the hearing of telephonic messages. A booklet on "Auristophone Therapy" sets forth how this instrument may be used in the cure of deafness.

The Northern Electrical Company, Duluth, Minn., has announced the closing of its Minneapolis branch office this week. The branch was established in Minneapolis about two and a half years ago and occupied its present location, 117 Hennepin Avenue, for about a year. It was in charge of Mr. Fred G. Dustin, a prominent Minnesota electrical engineer.

The Wallace Novelty Company, Incorporated, 22 East Forty-First Street, New York City, manufacturer of the Wallace portable general utility lamps, has completed arrangements whereby the Crescent Specialty Company, 4815 Vincennes Avenue, Chicago, Ill., will act as distributing agent for the state of Illinois. The Crescent Company will keep a complete stock of lamps on hand.

Felt & Tarrant Manufacturing Company, Chicago, Ill., has ready for distribution among those interested a booklet on how engineering calculations can be facilitated by the use of its Comptometer. This is a calculating machine that adds, subtracts, multiplies and divides. The booklet shows how engineers, contractors, architects, etc., can utilize the machine to good advantage.

The Gopher State Lumber Company, Plymouth Building, Minneapolis, Minn., was recently organized, with R. V. Norback as manager, to deal in white-cedar poles, ties, etc. Mr. Norbeck has been identified with the cedar industry for a number of years. He was formerly with the Standard Cedar and Lumber Company, and in 1909 connected himself with the Bell Lumber Company. His friends in the Northwest wish him success in his new venture.

Mathias Klein & Sons, 562 West Van Buren Street, Chicago, Ill., have ready for free distribution their new catalog No. 15 of linemen's, electricians' and mechanics' tools. This is a book of 64 pages with several hundred illustrations of the great variety of tools manufactured by this well known firm which began business in 1857. A brief history of the firm and its steady growth of business is given, together with several views of the different factories occupied at various stages of its career. Three indexes aid in finding any desired tool readily. This is a valuable catalog for the electrician who wishes to get reliable tools. Copies of the book can be obtained by writing the company at the address given.

The Oshkosh Manufacturing Company, Oshkosh, Wis., reports a very considerable increase in its business. The company is particularly pleased with the orders recently received from

foreign countries, among the recent shipments being a large shipment of Oshkosh tools for distribution to Australian lighting plants; a large shipment of electric construction and logging tools to the Philippine Islands; and a large shipment of tools to a New York commission house to be forwarded to the west coast of Africa. In addition to the above, the Oshkosh Company states that it is now receiving five or six times as many inquiries from American consumers as the company received last year at this time. Most of the Oshkosh Company's European business is shipped through the Western Electric Company.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., announces that the C-H push-button, 660-watt, brass-shell socket is now furnished on the following well known makes of portable lamp fixtures: the "Wallace," made by the Wallace Novelty Company, several models; the "Leindorf," made by the Leindorf Electric Light Company, Incorporated; the "Vanitie," made by the Aladdin Lamp Corporation; the "Dale," of the Dale Lighting Fixture Company; and the "Emeralite," of the H. G. McFadden Company. The indicating push-button socket has been found particularly advantageous because of the small neat design and the absence of the protruding rotary key. "Push the Button" is the direction given for operating the socket as well as for taking up the slack in the portable cord for a number of these portables. The small C-H electrolier socket is also in use on several styles made by some of the above makers of portables.

Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., reports receipt of the following among recent orders: Interborough Rapid Transit Company, New York City, six field-control motor equipments equipped with automatic battery control to operate on the new Belmont-Steinway tunnel. Oakland, Antioch & Eastern Railways Company, several quadruple equipments of 100-horsepower motors and type HL control, duplicating previous orders. Los Angeles & San Diego Beach Railways Company, a number of motor cars, locomotives and trailer cars equipped with Westinghouse No. 317 motors and automatic control, for train operation during the San Diego Exposition. General Construction Company, three 100-kilovolt-ampere, 60-cycle, 22,000 to 2,400-volt outdoor transformers. Reading Transit Company, Reading, Pa., three 185-kilovolt-ampere, 60-cycle, 2,300 to rotary voltage outdoor transformers. Arkansas Valley Railway Light & Power Company, Pueblo, Colo., three 150-kilovolt-ampere, 30-cycle, 22,000 to 460-volt outdoor transformers. Tennessee Power Company, Chattanooga, Tenn., a 220-kilovolt-ampere, three-phase, 60-cycle, 11,400 to 440-volt transformer. Chattanooga Railway & Light Company, one 300-kilovolt-ampere, three-phase, 60-cycle, 11,400 to 440-volt transformer. Hershey Transit Company, Hershey, Pa., several quadruple equipments of motors, duplicates of those purchased last year. Public Service Railway Corporation of New Jersey, 35 quadruple equipments of No. 307 motors with type HL control, for use on city lines throughout the Newark district and arranged for train operation; this company has standardized this type of control and has purchased to date 223 equipments for operation on both city and interurban lines.

Record of Electrical Patents.

Issued by the United States Patent Office, March 2, 1915.

1,129,840. Telephone. H. A. Bates, Galesburg, Ill. Means for locking the receiver hook against movement while the receiver is hanging thereon.

1,129,842. Electric Furnace. J. Blatchford, Oak Park, Ill. Has three resistance sections each connected in various ways by means of double-throw knife switches.

1,129,846. Electric Work-Light. T. F. Butzen and M. W. Kingsley, Milwaukee, Wis. Casing contains a self-winding reel compartment for the cord and a compartment for the lamp when not in use.

1,129,861. Electric Heater for Liquids. M. H. Gonzalez, Birmingham, Ala. Evaporator with heating units arranged in upper part of vessel only.

1,129,871. Electric Pocket-Lamp. W. Jerger, Sr., and M. Weiss, Berlin, Germany; said Jerger, Sr., assignor to said Weiss. Pistol type with battery located within the hollow butt.

1,129,878. Regulating Device for Motor-Driven Compressors. F. L. Lucker and A. O. Carpenter, assignors to Ingersoll-Rand Co., Jersey City, N. J. Automatic resistance type starter throws in driving motor when air pressure drops to a certain point.

1,129,942 and 1,129,943. Gaseous Repeater in Circuits of Low Impedance. H. De F. Arnold, assignor to Western Electric Co. Includes a number of Audions connected in series or multiple or series-multiple.

1,129,951. Telephone-Exchange System. E. S. Browning, Keefeton, Okla. Switchboard includes a breastplate with transverse slots and connecting levers oscillating in the slots to serve instead of cords.

1,129,959. System for Amplifying Electric Waves. E. H. Colpitts, assignor to Western Electric Co. Includes a number of Audion repeaters.

1,129,973. Outlet-Box Bushing. G. A. Gauthier, assignor to Arrow Electric Co., Hartford, Conn. For corner outlets of box; bushing fits opening in one wall and has arm closing opening in other wall. (See cut.)

1,129,982. Electric-Light Fitting. P. M. Hotchkin, Chicago, Ill. Branch box in center of fixture carries radiating side arms and bottom control switch.

1,129,987. Street-Car Indicator. T. E. Kearney and A. J. McFarlane, Berkley, Cal. Electrically controlled through contacts along trolley wire.

1,129,996. Time-Controlled Switch Mechanism for Electric Circuits. H. B. McCabe, assignor to Gisholt Machine Co., Madison, Wis. For periodic closing and opening of circuit.

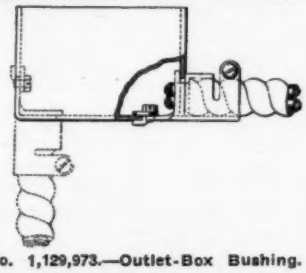
1,130,002. Headlight. F. F. MacLean, Syracuse, N. Y. Includes a stationary and a movable reflector, latter operated by an electric motor.

1,130,004. Safety Device for Starting-Motors. F. H. Miller, assignor to Westinghouse Electric & Mfg. Co. Prevents connecting starting motor to engine shaft until latter has dropped to low speed.

1,130,005. Crossover. S. P. Miller, Navasota, Tex. Has electrically operated track switches.

1,130,008 and 1,130,009. Audion. A. McL. Nicolson, assignor to Western Electric Co. In first patent the input electrode is in form of plate with filament wound around it between two output electrode plates. In second patent input and output electrodes are concentric shells with filament helically wound about inner shell.

1,130,010. Safety Device for Starting-Motors J. P. Nikonow, assignor to Westinghouse Electric & Mfg. Co. To protect connecting gears.



No. 1,129,973.—Outlet-Box Bushing.

1,130,017. Centrifugal Circuit-Changing Device for Electric Motors. E. S. Pillsbury, assignor to Century Electric Co., St. Louis, Mo. For changing repulsion to squirrel-cage induction motor on attaining speed.

1,130,028. Automatic Brake-Setting and Signal-Operating Apparatus for Railway Trains. T. H. Sheldon, Victor, Colo., assignor of one-half to F. Herz. Electrically controlled.

1,130,029. Telephonic Apparatus. H. E. Shreeve, assignor to Western Electric Co. Special construction for carbon chamber and perforated parabolic shield over diaphragm.

1,130,036. Device for Locating Faults in Line-Conductor Insulation. S. D. Sprong, Brooklyn, assignor of one-third to F. W. Smith and one-third to W. E. McCoy, New York, N. Y. Arranged on Wheatstone bridge principle.

1,130,041. Safety Device for Starting-Motors. S. Trood, assignor to Westinghouse Electric & Mfg. Co. Starting gear connection cannot be thrown in while engine is running.

1,130,042. High-Current-Output Audion. H. Johannes Van Der Bijl and A. McL. Nicolson, assignors to Western Electric Co. Input electrode in form of wire surrounded by filament in same plane: output electrode is plate parallel therewith.

1,130,043. Alternating-Current-Responsive Apparatus. H. J. Van Der Bijl, assignor to Western Electric Co. Thermionic repeater of Audion type connected to circuit through transformer.

1,130,052. Heater for Incubators. G. F. Armstrong, Hamilton, Ont., Canada. Resistance wire wound on mica sheets.

1,130,053 and 1,130,054. Driving Mechanism for Turrets and the Like. T. E. Barnum, assignor to Cutler-Hammer Clutch Co., Milwaukee, Wis. Two electric motors have a differential gear and reversing gearing between them and the driven shaft to obtain variable and reversible speed control.

1,130,066. Metal Founding. C. B. Carter, Chicago, Ill. Electromagnetically controlled molding machine.

1,130,077. Method of Making Contact Points. B. E. Eldred, Bronxville, N. Y. Platinum capped point over a layer of nickel.

1,130,079. Fire-Protection Device for Cinematograph Machines. E. W. Fox, Vancouver, B. C., Canada. Has circuit-closing switch operated by heat.

1,130,091. Program-Clock Apparatus. F. F. Landis, Waynesboro, Pa. Electric program clock and signaling equipment.

1,130,092. Electric Clock. F. F. Landis. Has electromagnetically actuated ratchet.

1,130,113. Globe-Holder for Electric, Gas and Other Lamps. J. A. Shaw, Montreal, Que., Canada. Has annular recess for bowed spring clip arms.

1,130,114. Vacuum Cleaning Apparatus. H. Small, assignor to Santo Mfg. Co., Philadelphia, Pa. Motor-driven suction fan at end of dust bag.

1,130,134. Electrically Controlled Change-Speed Mechanism. H. G. Baldwin, San Francisco, Cal. Electrically operated cam for shifting clutches.

1,130,161. Means for Controlling Electrically Operated Mechanism and the Like. H. H. R. Green, Forest Hill, England. Relay control.

1,130,162. Battery-Connector. N. Hale, Corpus Christi, Tex. Has spring clip terminals.

1,130,172. Embroidery-Pattern Machine. C. Keller, assignor to Keller Auto Co., West New York, N. J. Has electrically selected punches.

1,130,180. Headlight Attachment. W. F. Lennon, Willimantic, Conn. A cup-shaped body arranged to cover one side of incandescent lamp.

1,130,190. Telephone-Exchange Apparatus. C. H. North, assignor to F. C. Stevens, Attica, N. Y. Interchangeable unit comprising automatically operating switches and relays pertaining to a single trunk.

1,130,191. Mortuary-Illuminating Apparatus. J. O'Brien, Chicago, Ill. Ornamental floor lamp for use in morgue.

1,130,197. Process for Producing Tungsten Powder. R. Rafn, assignor to General Electric Co. Consists in heating tungsten trioxide to dull read heat in ammonia gas to produce blue tungsten oxide and then heating in an atmosphere of hydrogen at higher temperature.

1,130,204. Electric Switch. H. R. Schultz and F. B. Holt, assignors to Westinghouse Electric & Mfg. Co. High-potential oil switch with overload magnet in main casing and no-voltage magnet and release mechanism in auxiliary casing.

1,130,206. Magneto-Electric Machine for Combined Ignition and Illumination Purposes. F. R. Simms, assignor to Simms Magneto Co., Bloomfield, N. J. Has two pairs of pole shoes for two independent armatures.

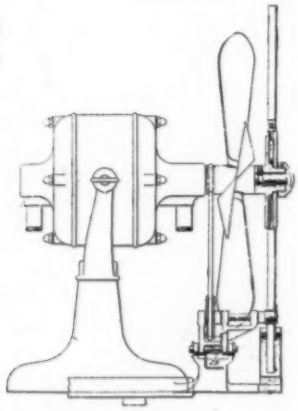
1,130,211. Dynamo-Electric Machine. C. W. Starker, assignor to Westinghouse Electric & Mfg. Co. Special end bracket.

1,130,212. Art of Removing Tarry Substances from Gas. F. W. Steere, assignor to Semet-Solvay Co., Solvay, N. Y. Consists in passing the gas through an electric field of alternating polarity and subjecting it to brush discharges.

1,130,213 and 1,130,214. Art of Removing Tar from Gas. F. W. Steere, assignor to Semet-Solvay Co. Consists in agglomerating the particles suspended in the gas by subjecting to action of brush discharge in alternating electric field.

1,130,215. Discharging Electrode and Method of Forming the Same. F. W. Steere, assignor to Semet-Solvay Co. Has a body of coke provided with discharging points.

1,130,218. Soldering Iron. S. Trood, assignor to Westinghouse Electric & Mfg. Co. Electric heater removably mounted in recessed working head.



No. 1,130,267.—Humidifier.

1,130,224. Air-Brake System. J. E. Wallace, New York, N. Y. Electrically operated valves.

1,130,239. Welding Machine. C. B. Auel and J. A. Burns, Pittsburgh Pa., assignors to Westinghouse Electric & Mfg. Co. Movable carriage supports electrode.

1,130,257. Generator for Intermittent Electric Currents. J. Carter, assignor of three-fourths to A. Long, Waukegan, Ill. Has permanent magnet with duplex pole piece, reciprocating armature and circuit-breaker.

1,130,258. Welding Machine. J. Cook, assignor to Westinghouse Electric & Mfg. Co. Wedling electrode is longitudinally moved along the work.

1,130,260. Transformer. W. M. Dann, assignor to Westinghouse Electric & Mfg. Co. Has an annular core with winding uniformly distributed about it and a two-part casing about the winding.

1,130,264. Resilient Driving Connection. G. M. Eaton, assignor to Westinghouse Electric & Mfg. Co. Between railway motor and drive wheels; includes a quill, tangential springs, gear wheels and friction clutches.

1,130,265. Rectifier System. C. Le G. Fortescue, assignor to Westinghouse Electric & Mfg. Co. Two mercury-arc rectifiers are connected to the secondaries of two current transformers on the same core.

1,130,267. Humidifier and Air-Cleaner. G. B. Griffin, assignor to Westinghouse Electric & Mfg. Co. Electric fan has slowly rotating fabric-covered wheel in front that dips into trough. (See cut.)

1,130,268 and 1,130,269. Electrical Transformer. E. Haefely, assignor to Westinghouse Electric & Mfg. Co. First patent provides insulating and barrier structure comprising a rigid sleeve of insulating material, a sleeve of absorbent insulating material and an oil immersion bath. Second patent provides an insulating barrier of polygonal cross section between the circular primary and secondary coils whereby ventilating spaces are formed.

1,130,270. Egg Tester. J. M. Halley, Keytesville, Mo. Electric lamp on reciprocatory receptacle.

1,130,320. Circuit-Controller. W. Morrison, Des Moines, Iowa. Rotatable circuit-closer with actuating bar and escapement mechanism permitting step-by-step rotation in only one direction.

1,130,340. Trolley Switch. J. J. Ruddick, assignor to United States Electric Signal Co., West Newton, Mass. Includes pivoted trip actuated by trolley wheel.

1,130,353. System of Automatic Block-Signaling. F. Townsend, New York, N. Y., assignor to General Railway Signal Co. For electric railways.

1,130,359 and 1,130,360. Trolley-Wheel Mount. J. Wilder, Augusta, Me. Springs in harp permit swiveling of wheel.

1,130,361. Trolley Head. A. L. Williams, Los Angeles, Cal. Has two wheels in tandem.

1,130,391. Headlight. C. J. Geterman, assignor to J. E. McLain, Canton, O. Arc lamp with inclined carbons and reflector.

1,130,392. Electrical Oven and Kiln. L. H. Giddings, Pasadena, Cal. Resistances in the jacket.

1,130,414. Apparatus for Preventing Railway Accidents. H. L. Lockhart, Philadelphia, Pa. Electromagnetically controlled tripping lever.

1,130,451. Projecting Lantern. E. Unger, New York, N. Y. Lamp housing reinforced where electrodes pass through.

1,130,460. Electric Arc Lamp. A. Zanotta, Milan, Italy. Projector type lamp has three electrodes with the two outer ones inclined with respect to the middle one.

1,130,476. Rheostat Controller. G. P. Carroll, Bridgeport, Conn. Motor driving ammonia compressor is started and stopped through thermostatic resistance controller.

1,130,482. Junction Box. C. W. Davis, assignor to Standard Underground Cable Co., Pittsburgh, Pa. Cable box with circular busbars and connecting studs in lower compartment.

1,130,483. Terminal for Cables Entering Junction Boxes. C. W. Davis, assignor to Standard Underground Cable Co. Strain-sustaining thimble to protect lead sheath of cable where it is soldered to the wall of box.

1,130,484. to 1,130,487. Electric Fuse. C. W. Davis, assignor to Standard Underground Cable Co. Four patents covering fuses for high-tension underground cables; first patent provides electromagnet to move one terminal so as to rupture the arc; last three patents cover oil-immersed fuses of different types.

1,130,494. Spark Plug. A. H. Dingman, Allison Park, Pa., assignor of one-half to H. Kappeler. Has elongated shallow casing.

1,130,496. Lamp Shade. J. W. Dunham, New York, N. Y. Has arms for gripping the bulb in various angles.

1,130,518. Pneumatic-Dispatch-Tube Apparatus. C. S. Jennings, assignor to American Pneumatic Service Co., Boston, Mass. The pump-driving motor can be started in either direction so as to carry parcels either way through single tube.

1,130,522. Party-Line Listening-In-Detecting Device. C. A. Kramer, Spokane, Wash. Removal of receiver from hook causes the striking of a bell adjoining the transmitter.

1,130,547. Electric Motor. F. L. Sessions, assignor to Jeffrey Manufacturing Co., Columbus, O. Has completely inclosed casing.

1,130,567. Electric Lantern. B. K. Bunch, Marshall, Mo. Hood carrying reflector, lamp and lens is secured to and overhangs upper part of dry cell.

1,130,573. Safety Device for Starting Motors. F. Conrad, assignor to Westinghouse Electric & Mfg. Co. Prevents throwing in the connecting gears while engine is running.

1,130,591. Display-Rack for Electric Wires. L. Gray, New York, N. Y. Made of pipe framework with horizontal pipes as spool holders.

1,130,608. Telephone Attachment. P. A. Johnson, Springfield, Ore. Removal of receiver from hook causes spring motor to produce fluctuation of line current.

1,130,612. Trolley Protective System. A. Klimes, Chicago, Ill., assignor of two-fifths to J. Kolda. Sectionalizing switches cut out any section having broken trolley wire.

1,130,626. Base Member for Separable Attachment-Plugs. J. G. Peterson, assignor to Manhattan Electrical Supply Co., Jersey City, N. J. Has two longitudinal recesses, each containing a spring contact connected to screw shell and middle contact, respectively. (See cut.)

1,130,628. Rotary Igniter. B. W. Pierce, Appleton, Wis. Has rotating stem with contact arm.

1,130,633. Polarity-Indicator. F. W. Roller, assignor to Roller-Smith Co., New York, N. Y. Has three positions corresponding to the two directions of current and to no-current condition dependent on magnetic action.

1,130,640. Battery-Separator and Process of Making the Same. J. M. Skinner, assignor to Philadelphia Storage Battery Co., Philadelphia, Pa. Prepared by boiling the wood of coniferous trees in water for 24 to 48 hours.

1,130,648. Magnetic Separator. G. Ullrich, assignor to Fried. Krupp Aktiengesellschaft, Grusonwerk, Germany. Material is fed between stationary poles whose strength is sectionally adjusted.

1,130,650. Process of Hardening the Cutting Portions of Cutting Tools. J. Whitaker, North Wales, Pa. Saw teeth are tempered by electric heating.

1,130,654. Relay. Harry R. Allensworth, Columbus, O. Includes a diaphragm for receiving the vibrations and a fluid medium for transmitting them.

1,130,675. Safety Device for Starting-Motors. C. B. Mills, assignor to Westinghouse Electric & Mfg. Co. Prevents connecting of the motor while engine is running under its own power.

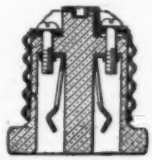
1,130,676. Electric Horn. D. P. Perry, Chicago, Ill. Includes a spring connection between the diaphragm and the armature of an electric buzzer.

1,130,678. Process of Manufacturing an Iron Alloy for Dynamo-Electric Purposes. W. Rübel, Westend, Germany. Comprises deoxidizing purified and superoxidized iron by means of an earth-alkali metal in the form of an alloy of copper.

1,130,686. Means for Exciting the Commutating Poles of a Dynamo-Electric Machine. J. L. Woodbridge, Philadelphia, Pa. Synchronous converter of split-pole type with synchronously driven exciter for supplying to commutating poles a current proportional to that in the D. C. leads.

1,130,687. Car-Axle Lighting System. J. L. Woodbridge. Includes exciter with one set of brushes connected to battery and the other set to the dynamo field.

1,130,688. Rapid Printing-Telegraph System. C. G. Ashley, assignor to General Engineering & Construction Co., Ltd., Ontario, Canada. Includes means for impressing on the line current impulses of predetermined polarity and duration.



No. 1,130,626.—Attachment-Plug Base.

Patents Expired.

The following United States electrical patents expired on March 8, 1915:

600,134. Electric Locomotive. H. Bitner, Chicago, Ill.

600,202. Trolley-Wire System. W. J. Kauffman, E. W. Conkell and O. F. Kauffman, Canton, O.

600,208. Polyphase-Current Transformer. C. Kurda, Nuremberg, Germany.

600,230. Electrotherapeutic Exercising Apparatus. A. Martin, Paris, France.

600,252. Means for Arresting Motion of Electric Cars. W. C. Anderson, West Hoboken, N. J.

600,265. Electrical Measuring Instrument. A. H. Hoyt, Penacook, N. H.

600,277. Electric Arc Lamp. J. H. Duncan, San Francisco, Cal.

600,278. Automatic Switch for Railways. H. F. Eaton, Quincy, Mass.

600,285. Electric Heater. R. J. Holland, New York, N. Y.

600,336. Insulating Connector. H. E. Pearce, Brooklyn, N. Y.

600,356. Automatic Regulator for Electric Currents. J. D. C. Chateau, Paris, France.

600,380. Galvanic Apparatus. G. H. A. Schaefer, Buffalo, N. Y.

600,381. Electric Railway. J. F. Scherpe, St. Louis, Mo.

600,383. Electrically Operated Brush. A. Sherwood, Topeka, Kans.

600,417. Electric Heater. E. E. Gold, New York, N. Y.

600,457. Electrical Battery. N. B. Stubblefield, Murray, Ky.

600,475. Electrical Insulator and Method of Making Same. J. W. Boch, East Liverpool, O.